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THE UTWA HARBOR WRECK SITE:
A SHIPWRECK EVALUATION AND MANAGEMENT REPORT

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THE UTWA HARBOR WRECK SITE:
A SHIPWRECK EVALUATION AND MANAGEMENT REPORT

by
Daniel J. Lenihan
Toni Carrell
Larry Murphy

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United States Department of the Interior
National Park Service
Submerged Cultural Resources Unit

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INTRODUCTION

The High Commissioner of the Trust Territories of the Pacific Islands, Adrian A. Winkel, requested the assistance of the National Park Service, through Director Russell Dickenson, for a preliminary assessment of a shipwreck site in Utwa Harbor, Kosrae. As a result of this request a cooperative agreement was signed between the National Park Service and the Trust Territories of the Pacific Islands. Three archeologists, comprising the Service's Submerged Cultural Resources Unit, were directed to evaluate the wreck site and offer management suggestions to the Trust Territories Historic Preservation Office in Saipan.

The Saipan office is charged with the responsibility for coordinating cultural resources programs within the Trust Territories. As of January 1, 1981, the Island of Kosrae, along with Truk, Ponape and Yap, became the Federated States of Micronesia and are no longer in Trust Territory status. Historic preservation programs are continuing in the FSM but for the present are still being coordinated in Saipan.

The foresight of the people of Kosrae State regarding the preservation of their cultural heritage provided the impetus which resulted in the National Park Service Submerged Cultural Resources Unit's participation in this joint venture. Unit personnel spent 8 days, January 31 through February 7, 1981, mapping, photographing, and videotaping the wreck site suspected to be the Leonora, captained by William Henry (Bully) Hayes, which sank in Utwa Harbor in 1874.

OBJECTIVES

At the request of the Chief of Utwa, Kan Isiah, the Trust Territory State Historic Preservation Office is considering options for managing the shipwreck site located in Utwa Harbor, Kosrae. This ship, presumed to be the Leonora, is one of the more significant historic properties located on Kosrae. While anchored in Utwa Harbor in 1874, a storm blew up and sank the Leonora before Captain Hayes was able to move her to a safer anchorage. Descendants of Hayes and other crew members have survived to this day and some currently reside on the island of Kosrae.

Prior to the acquisition of development funds for the site, a pre-development plan is required; in this case, an underwater archeological evaluation was needed. This work, completed under a cooperative agreement with the National Park Service, is part of the Trust Territory Historic Preservation Office Survey and Planning Program.

Scope of Work

This scope of work, identified by the Trust Territory State Historic Preservation Office and agreed to by the National Park Service, was to undertake identification, mapping and photo documentation of a shipwreck site in Utwa Harbor, Kosrae.

The specific tasks to be completed as part of the plan were:

1. Determine if the wreck is of correct size, class of vessel and period to be the Leonora.
2. Preliminary reconnaissance of the wreck site to locate and identify isolated or scattered areas.
3. Mapping of the site including a planimetric map of the exposed portions of the wreck with all significant exposed features. Establish primary and secondary datums in such a manner as to permit survey in from landbased transit.
4. Photo documentation of the site including photography of all exposed areas of the wreck.
5. Construction of a semi-controlled photomosaic of wreck site. A semi-controlled mosaic is composed of uncorrected vertical photographs laid to a limited ground control.
6. Description of the present state of preservation of the wreck including photographs, observation, and wherever possible non destructive testing with probes, needles, etc.
7. Preparation of a report documenting all work undertaken, including a planimetric base map, photos of the site, and if feasible, a semi-controlled photo mosaic of the wreck. A discussion of management alternatives and estimate of costs for each alternative is also to be provided.

THIS REPORT

This report is composed of primary text written by the Submerged Cultural Resources Unit, a site map, a series of photos taken by the team on site and an appended copy of a report by Paul Ehrlich which is the historical background component of this shipwreck evaluation effort. Dr. Ehrlich's contribution is designated "preliminary" and there may be a finalized version available in the future.

There are several items to be used as supplements to this Utwa Harbor Wreck Site Report. They include a photomosaic of the visible site features, a series of color photos which were forwarded prior to the

report itself, and an edited and narrated $\frac{1}{2}$ inch reel to reel video summary of the Unit's findings.

Measurements in this report are given in metric system where general site mapping is concerned. In some cases, at the discretion of the authors, feet and inches are used. For instance, most measurements of structural elements of ships and certain artifacts are more meaningful when given in the units utilized in the minds of the builders; also depth gauges used by this team are calibrated in feet.

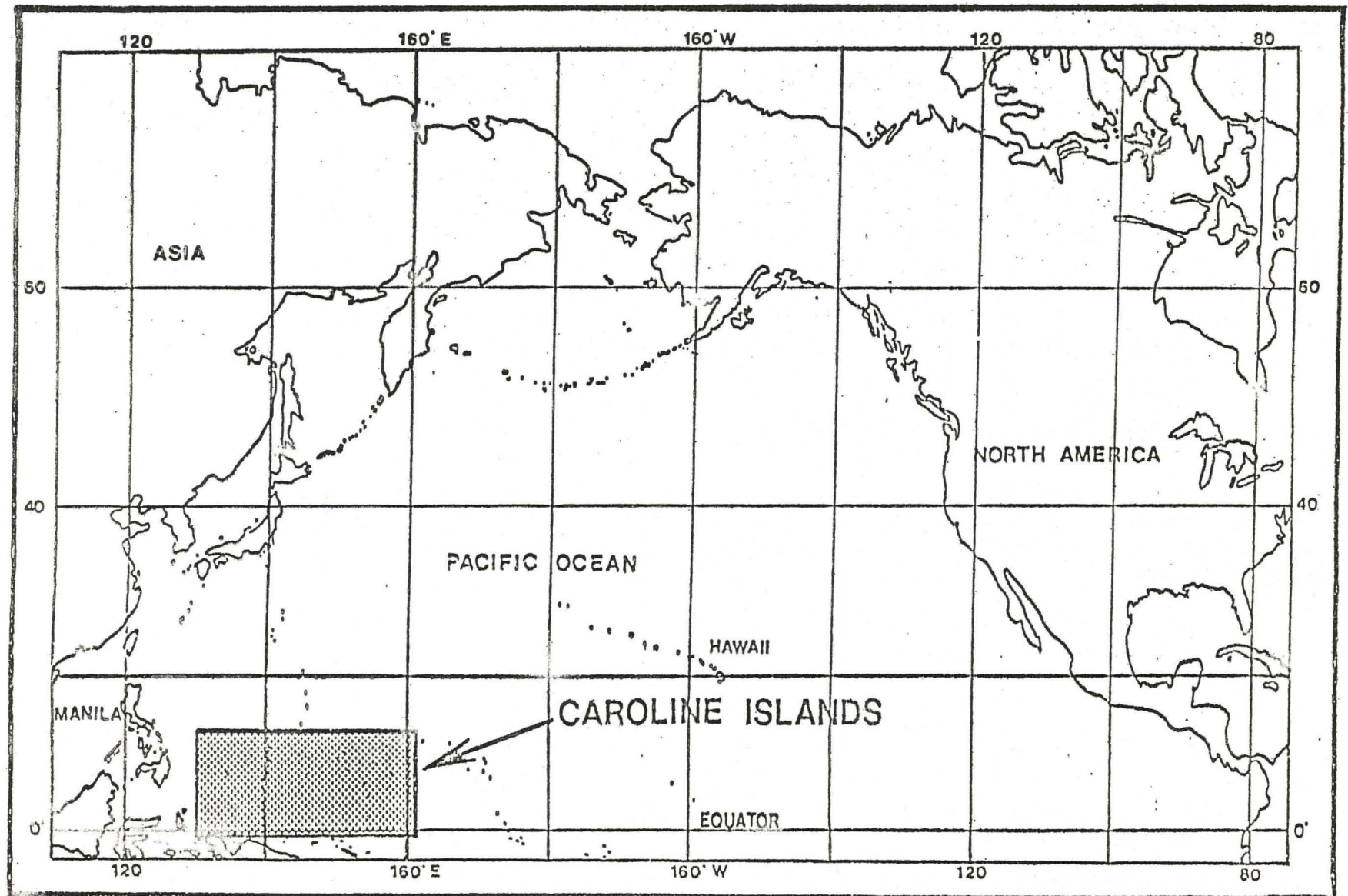
SITE SETTING AND DESCRIPTION

The Caroline Islands, located approximately 2500 miles southwest of Hawaii and 1100 miles east of the Philippines, are composed of several smaller island groups running in an east-west chain 2200 miles long extending from latitude 3° 02' North, longitude 131° 10' East to latitude 5° 16' North, longitude 163° 02' East (Figure 1). Part of the Micronesian area of culture influence, the Carolines are divided into four major districts: Palau, Yap, Truk and Ponape, from west to east respectively (USDI, 1973).

Kosrae, in the Ponape district, is the easternmost of the Caroline Islands. Volcanically formed rather than an atoll, Kosrae is high and generally triangular in outline, encompassing an area of 42 square miles. Its wet, mountainous interior is divided into two masses by a deep corridor from Lele Harbor on the east, up the Infaal River Valley across a low gap and down the Okat River to Okat Harbor. The highest point on the island, Mt. Fenkol at 2064 feet, is part of a chain of mountains curving from the southwest corner to the southeast corner, with an extension up both the west and east coasts. The coastal lowlands are narrow, edged by mangrove thickets and offshore islets (Byran 1971). Typical of young volcanically formed islands in the Pacific, a narrow fringing reef encircles Kosrae dropping off to over 1300 feet on the outside (Defense Mapping Agency Rev. 1981).

Utwā Harbor, located on the south side of the island, consists of a shallow inner reef bisected on the Northwest by the Utwa River

Figure 1



(Figure 2). The sediment-laden runoff from this freshwater river has inhibited coral growth in the stream channel, thus providing a deep natural shelter for boats with ready access to shore. It was within this inlet that Hayes reportedly moored the Leonora in 1874.

The wreck site at Utwa Harbor is at the base of a living coral cliff which rises from a depth of 35 feet to within 6 feet of the surface. The water depth and proximity to the cliff apparently provides some protection for the wreck site from mechanical disturbances caused by wave action. The Utwa River empties its sediment load in the vicinity of the wreck remains and is the principal contributor of the deep organic silt overburden covering the site. During the outgoing tide the suspended silt is transported across the shallow reef area considerably reducing the water visibility over the site.

The fine, black organic silt covers most of the site remains, reaching a depth in excess of 3 meters in places within the main wreck concentration area. This mantle of silt is responsible for the high preservation potential of the site for two reasons: 1) the silt has created an environment conducive to the survival of most classes of wreck materials, and 2) it has covered the major concentration of wreckage preventing casual removal by looters.

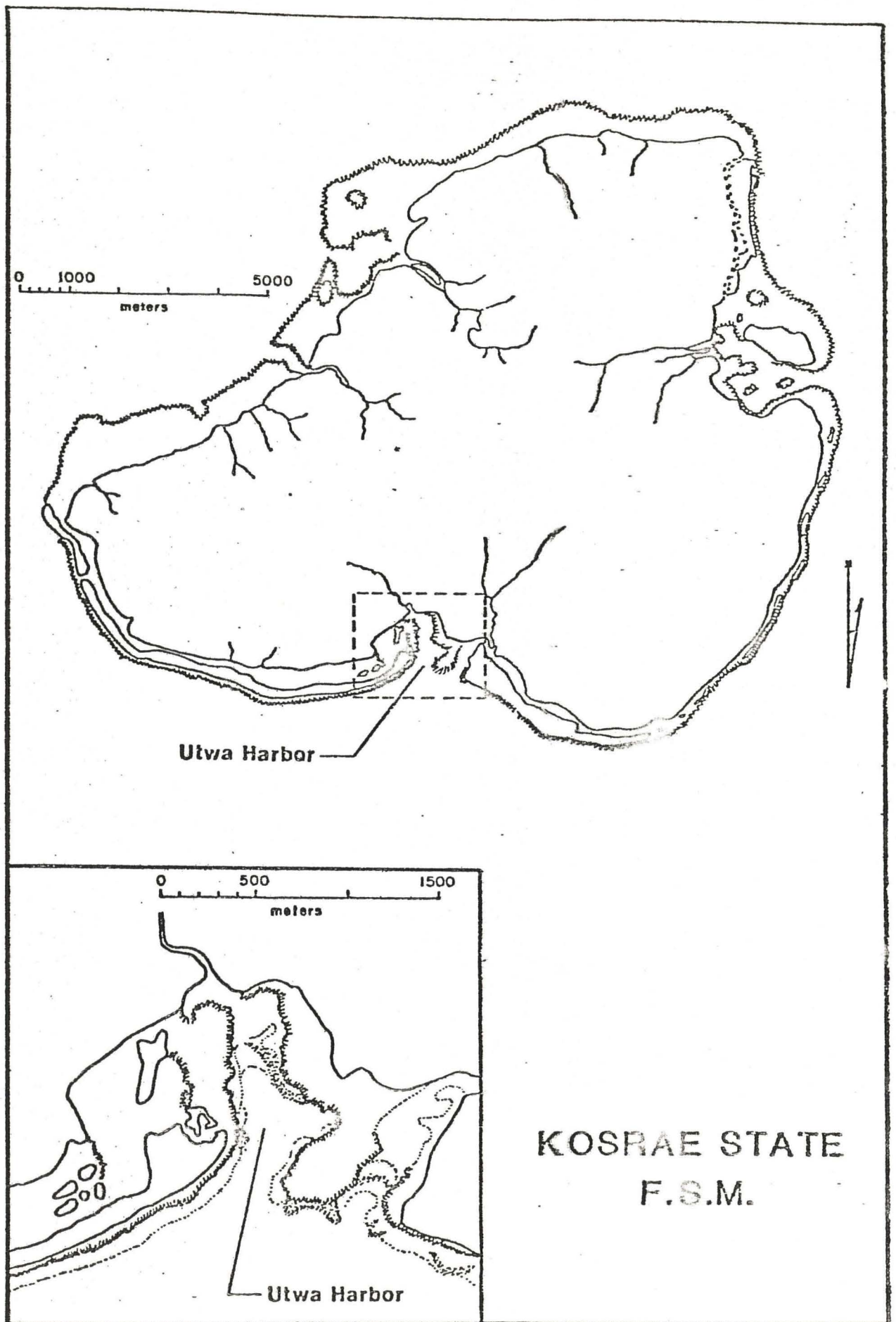


Figure 2

FIELD METHODOLOGY

The Submerged Cultural Resources Unit was taken to the area of the Utwa Harbor shipwreck by members of the Historic Preservation Office under the direction of Teddy John. Diver Julian Jonah led the inwater search for the site. The wreck was located some 40 minutes into the first dive in 25 - 40 feet of water. The site was examined and preliminary photographs were taken.

Mapping procedures were begun during the next day. A baseline consisting of a yellow polypropylene line painted black on alternate meters, was laid at a depth of 40 feet on the seaward side of all visible wreck remains.

The various elements visible above the silt were given feature numbers. Each feature was measured in from the baseline by trilateration from two tapes placed in appropriate positions on the line. Dr. Paul Erlich and Robert Adair assisted Julian Jonah and Unit personnel with the measurements of the site. Three divers were involved with measurements while others alternated photographing and sketching the features. The relative position of the coral ledge was located by measuring the perpendicular distance at each meter from the baseline.

Each feature was examined, measured and photographed. There were no test excavations done on any feature, except brief hand fanning in the ballast concentration area (feature 3). This limited subsurface examination produced fragments of wood in a well preserved state.

In addition to individual black and white and color photographs, a semi-controlled photomosaic of the site area was done. The baseline was extended in parallel lanes 1 meter apart to serve as ground control for the photographing of the mosaic. The height of the camera was maintained at 2 meters above the site by hanging a brass plumb-bob on a clear monofilament line. Horizontal control was reached with a "bull's eye" circular bubble level fixed to the back of the camera body. The camera used was a Nikonos 35mm underwater camera with a 15mm lens and optical viewfinder modified by the attachment of a cross hair aiming frame so the plumb-bob could be centered in the viewfinder. A photograph was taken at 1.5 meter intervals on each ground control line. The front-lap and side-lap was sufficient for the construction of the mosaic.

Videographic documentation was also carried out on the wreck with a Video Sciences closed-circuit underwater television. Video tapes were made of the wreck and have been edited to produce a 20 minute tape, providing a base for comparison of future impacts to the site should visitation of the site increase.

The top of the reef in the vicinity of the site was surveyed by personnel of the Historic Preservation Office. Unit archeologists swam the bottom of the reef line for approximately $\frac{1}{4}$ mile in both directions from the exposed site area in an attempt to locate any additional visible wreck remains; none were located. Metal detector surveys of the top of the reef may produce ferrous components which have been covered by reef growth and are otherwise unrecognizable.

Probing operations were carried out randomly within the delineated site area with a three-meter rod. The probe was pushed into the silt as far as the divers could reach in the river channel adjacent to the site registering approximately 4 meters (including the diver's arm) in many places.

No surface collections or test excavations were done, although there was some hand fanning in feature 3 within the main ballast concentration. No artifacts were removed from the site.

SHIPWRECK EVALUATION

The Submerged Cultural Resources Unit was mandated to assess the Utwa Harbor site through observation of surface remains and probes where feasible. Since the great majority of the site is covered with overburden it is impossible to provide a comprehensive description of the major portion of the wreck remains without at least partial excavation. For evaluative purposes, the following verbal description, photographs of visible features and map (figure 3 appended) are considered the best format of presentation without engaging in major bottom disturbance. Most of the features were dusted off before photos were taken but the light, protective layer of silt was re-established by natural deposition from the river almost immediately.

EXPOSED FEATURES

Feature 1

This is the most visible feature of the wreck site. It is a long copper sheathed hollow box 3 meters of which is visible before the north end disappears under the coral bank into the silt. It is located under a coral ledge on the eastern portion of the site area. The widest portion is 70 cm at a point 1.5 meters from the open northern end. At one meter from the northern end the width is 60 cm and tapers to 42 centimeters. The depth of the structure consistently is 25 centimeters. The entire visible portion of the box is tightly sheathed with copper

sheets similar to the hull sheathing found on the site. The sheathing is very tightly applied with overlapping seams. The color of the copper sheathing is light green which results from exposure to an oxidizing environment indicating the item probably has not been buried by silt.

The function of the structure is not certain. Normally, only areas below the water line of a vessel which are subject to the action of marine borers are sheathed. This object is sheathed all around which indicates that it is probably not part of the lower hull or rudder assembly. One possibility for the use of the feature is as a water tank. Ehrlich quotes, from Commander Meade's report of 1872, that the Leonora had... "water tanks: of from 150 to 400 gallons; ship carried about 1100 gallons" (Ehrlich 1981:7). The visible portion of the item would have a capacity of about 140 gallons (18 cu. ft.) which would put the size of the entire structure in the range of the tanks listed aboard the vessel. At the time of wrecking, Becke reported six four-hundred gallon water tanks were lost overboard (Ehrlich 1981:11).

Feature 2

This is an area of exposed copper hull sheathing.

Feature 3

This feature is a concentration of ballast. Commander Meade's report (Naragansett, 1872 in Ehrlich 1981:7) lists 75 tons of ballast; 50 of stone, and 25 of scrap iron. Ballast carried aboard sailing ships

normally comprised roughly 1/3 of the total weight of the ship, with the ship itself accounting for roughly 1/3, leaving 1/3 for cargo capacity. An estimate of ballast visible on the site is 5% of the total stone ballast expected in a vessel of the size of the Leonora. It is distributed over an area of 50 square feet of the center portion of the site. A portion of wood was uncovered by handfanning in this feature.

Feature 4

Feature 4 is comprised of copper sheathing visible on the surface extending into the silt.

Feature 5

An area of visible copper sheathing, most of which is still articulated and held together by copper tacks. The sheathing extends into the silt and may be connected under the ballast (feature 3). These features (2, 3, 4, 5) represent a portion of the hull which came to rest in this location. Associated with this complex are two angle irons 2½ feet long connected by three smaller iron members. This artifact could be iron reinforcing, i.e. a structural element, although, it may also be part of the 25 tons of scrap iron used for ballast (note Meade's report 1872, in Ehrlich 1981:7).

Feature 6

A rectangular piece of iron with a 10-inch brass pin 1½ inches in diameter. The pin is of the type expected for use in construction of

marine vessels and is most probably a structural element. Historical research and further archeological investigations on the site should reveal whether the Lenora had such iron structural elements. Such a determination would provide additional corroborative support for the Utwa wreck site being the Leonora. Associated with this feature is an iron ring which is a rigging element.

Feature 7

This feature is composed of two iron uprights which extend some 3 feet above the silt. There is a depression or hole in the northern upright. While these could be part of the scrap iron ballast, the hole suggests the possibility of a bilge pump. Test excavations in the area would clarify the nature of these iron elements.

Feature 8

A square iron artifact similar to that of feature 5 and, like that artifact, could be a structural member or simply a portion of the scrap iron ballast.

Feature 9

A rectangular solid iron member with an 1½ inch diameter copper alloy fastener similar to that of feature 5. This could be a structural element as well.

DISCUSSION

The site examined in Utwa Harbor represents shipwreck concentration of the type expected from a portion of lower hull coming to rest and deteriorating. The articulated hull sheathing evidently extends beneath the stone ballast concentration and is indicative of a vessel of the same period as the Leonora. The main site concentration area and visible features represent about 1/3 of the area expected if a ship of 200+ tons settled without being badly broken up. As stated above, no more than 5% of the expected ballast was visible within the confines of the site. The existence of the deep organic silt (3 - 4 meters in depth in places) and the apparent slope of the sand substrate suggests the strong probability that much of the remainder of the wreck lies buried in a state of good preservation. Only test excavation can conclusively determine whether this is the case, however, assuming the vessel remains are those of the Leonora, some idea of the nature and extent of the breakup can be obtained from the historical record.

The Leonora was wrecked when heavy swells entered the mouth of Utwa Harbor. The swells, coming from the south, had enough force to drive the vessel against the reef. It is reported that the vessel swung around on its cable and the rudder was sent "... clean through the deck" (Becke in Ehrlich 1981:12). There were six 400-gallon water tanks lost on the port side. The copper sheathed structure (feature 1) was found on the east side of the site which would have corresponded to the port side if the ship sank bow to the waves. At least a portion of

the hull structure came to rest within the confines of the area designated on the site map. Though the stern was undoubtedly heavily damaged it is unlikely the ship disintegrated since the Kosraens were able to salvage some material from the wreck soon after the storm (Ehrlich 1981: 12). A sweep of the reef area surrounding the wreck site by Kosraen divers, at the request of the archeological team, revealed no additional wreck material.

This scenario of initial wreck deposition is speculative, but useful for future research planning. If the remains examined in Utwa Harbor are those of the Leonora it is likely they represent a portion of the stern of the vessel and the remainder lies under the silt overburden. The probability is high that much of the wreck lies buried in the deeper sections of the examined site area in the silt-filled river channel. Metal detectors or a high resolution magnetometer search coupled with test excavations could determine the extent of the remains of this vessel.

There is some question whether the Leonora was a brig or brigantine. The contemporary sketch of the Leonora (formerly the Pioneer and Water Lilly) which is presented by Ehrlich is of a brig; however, it is stated that the vessel was ". . . a sleek 218 ton brigantine with two masts; she was square rigged with three jibs" (Ehrlich 1981:4). A brigantine normally has a fore and aft sail on the main mast, while a brig is square rigged on both masts. The vessel may have been re-rigged when the copper sheathing was removed from the vessel and the sails shorn (Hazel p. 13, in Ehrlich 1981:6).

Originally, the term bergantino or brigantino was widely used in the fourteenth century to denote a Mediterranean vessel which was a small, fast undecked ship. The brigantine rig was later common on two masted sloops. In 1771 the term "brig" appears in the English Navy list for the first time. Initially, it may have been a contraction of brigantine, but it later indicated a special, standardized form of the brigantine rig, which then varied widely. Falconer (1769) in the Universal Dictionary of the Marine used brigantine and brig synonymously, but by 1794 the term brigantine evidently went out of use until the mid-nineteenth century when it referred to a distinctive rig which included a fore and aft sail on the main mast.

Organic materials from shipwreck sites have been recovered in remarkable states of preservation as a result of their burial in fine sand and mud conditions. Preservation of delicate organic materials is due in part to protection from mechanical impacts and the creation of an anaerobic environment which inhibits the growth and development of certain destructive micro-organisms and eliminates the effects of oxygen. The nature and extent of bacterial activity is an important factor in organic preservation. Anaerobic conditions, which frequently produce a acidic local pH (seawater is usually slightly alkaline 7.5 - 8.5), contribute to reduced bacterial action. Normally, organic materials survive better in a reducing environment where sediments vary from grey to green to black (Hill 1963). Cold water can enhance the preservation of organic materials, but they have also been recovered in the warm waters of the Atlantic and Gulf coasts off Florida.

Other than the organic material which makes up rigging, cargo, and personal effects of those onboard, the wood of the vessel structure itself would be the primary organic remains. Large sections of intact hull may be preserved under the right conditions (such as those found on the Utwa Harbor site). However, even if only small fragments remain, they can be a source of significant data on construction techniques, tool types and uses, and the practices of shipwrights and carpenters of that period of vessel construction.

There is a probability of good preservation of wood on the Utwa shipwreck. The silt would provide a micro-environment conducive to wood preservation, especially if the siltation rate was high after the initial deposition of the wreck. Marine borers would be responsible for the destruction of exposed wood soon after deposition, however, those portions below the silt within the reducing environment would be protected, as the borers cannot live without free oxygen present. Depending on the mechanics of initial deposition, large structural elements may be preserved under the silt if the vessel broke up or, perhaps, the lower section of the hull or the side may be preserved with the exposed portions above the silt destroyed by biological action.

The silt matrix will also have effects on the metallic portions of the vessel. The most abundant metal visible on the surface of the site is copper sheathing. Ordinarily, copper alloy metals have a dark blue-black appearance when recovered from reducing environments and a pale green color when recovered from an oxidizing context. Copper-zinc alloys (brasses) tend to lose the zinc from the alloy over time, but if

composed of 85% or more of copper, they normally remain structurally unchanged. From the appearance and condition of the copper sheathing examined at the Kosrae State Historic Preservation Office and on site, the material has been exposed to circulating seawater (i.e. uncovered) for a long period of time.

Ships were generally not sheathed in metal until the latter part of the 18th century. Sheet metal became plentiful after the development of steam rolling mills. It is reported that the British battle fleet was sheathed during the American Revolution and by the turn of the 19th century, merchantmen were sheathed as well (Peterson 1973:123). Metallurgical analysis of the copper sheathing, nails and bronze fasteners may be able to lend supporting data to the date of construction for the shipwreck remains at Utwa Harbor.

Cast iron, such as found in cannonballs and ships fittings, is affected by bacteria and corrodes in an oxidizing environment. Iron can reach a stabilized condition under the water which will greatly slow its deterioration, but loss of even large artifacts can occur rapidly upon being exposed to air and being allowed to dry out. Mechanical forces which result from the crystallization of salts combined with internal rusting, in the instance of cast iron artifacts, are sufficient to spall off large portions of metal and lead to the eventual breakup of the artifact. Removal of artifacts, whether from the water itself or from the overburden while still submerged, sets up a new destructive cycle until equilibration is again achieved.

The wreck environment presented by the site in Utwa Harbor thus has a high potential for excellent preservation of organic remains. The fine silt which covers the site can produce an anaerobic environment conducive to the preservation of bone, leather, hair, iron, fiber, etc. The location of organic remains such as softwood and sails may support the identification of the remains as that of the Leonora.

ARCHEOLOGICAL RESEARCH POTENTIAL

Traditionally the approach for studying shipwrecks in the new and old worlds has been almost exclusively particularistic in nature. There have been some recent attempts to look for universal laws and general behavioral models in maritime archeology (e.g., Muckleroy 1978), but they have been few. Although the National Park Service has been taking a lead in developing viable models in the new world for applying anthropology to wreck studies, this is still in the formative stage and is only tangential to the discussion in this report.

As in land archeology, the material remains of a ship can be studied with two major concerns manifested: what the site can tell us about the cultural activity that makes it an entity in the archeological record and what it can reveal about the influence of environmental factors. The interplay of "N and C transforms" as they are termed by Schiffer (1976) on a wreck site are somewhat different than most other types of sites. The event of sinking and being deposited on the bottom of the ocean is a very definitive one in respect to separating natural

from cultural post-depositional dynamics. All contemporary cultural activity immediately ceases with the exception of possible salvage attempts and the site is left to a spectrum of natural effects. Depending on the depositional environment, subsequent mechanical disturbance of the site may be minimal. In the case of the Utwa Harbor wreck it is probable that there were some further effects of wave action on the wreck after its initial deposition since it is in fairly shallow water 20-40', and occasionally exposed to wind generated waves from the same quarter as produced by the storm that originally sank the vessel. It is also probable, however, that the severity of impact would not have been great since the lower portion of the vessel including the hull and all the heavy structural elements would be in water deep enough to protect them. Reconnaissance of the area by the Submerged Cultural Resources Unit lends support to this hypothesis.

Although most of the site was covered by silt and coral growth, all surface indications point to a fairly confined concentration of wreckage. Storm wrecks in high energy beach zones in Florida, for example, may be scattered over many acres of bottom. The Utwa site seems to be delimited to an area comprising the surface features described above and the adjacent river channel. An earlier verbal report of an existing outline of the vessel could not be substantiated by the team. If that report was accurate, there may be a large intact section of hull timbers in the silt laden river channel immediately adjacent to the coral covered bank, but it would take heavy excavating equipment to confirm this.

In addition to the mechanical factors influencing the natural transformational process of any underwater site are the biochemical effects. The heavy sediment overburden on most portions of the wreck has provided a very benign environment for preservation. As discussed in the section on wreck description, this means that most classes of material remains usually found on wreck sites may be preserved in the Utwa Harbor Wreck.

As an archeological entity the site believed to be the wreck of the Leonora can be seen as particularly valuable. The remains are in a good state of preservation and have been subjected, as far as can be determined, to minimal post-depositional human impacts. The natural forces that resulted in its deposition over the bottom should be fairly easy to reconstruct through an intensive research effort.

An examination of Ehrlich's historical research (appended) and other relevant documents indicates a degree of confusion and contradiction regarding the nature of the vessel, its cargo and contemporary salvage efforts. The archeological record is a powerful complement to historical studies which tend to state only what contemporary recorders perceived to be true or what they wanted posterity to believe was true.

Many questions of a particularist nature may be addressed through excavation at the site, e.g., what was the actual morphology of the vessel, how it was rigged, was its cargo really pigs and yams, was pig iron part of its ballast, was it fully sheathed in copper below the water line, how much was removed by contemporary salvors? There are

also a host of social scientific issues that can be addressed through research at this site. The institution of smuggling and illicit trade is a form of socially deviant behavior that is no place better documented than in shipwreck sites. If the Leonora was formerly used in the opium trade, and recognizable as a class of vessel serving that function, what elements of design made this obvious to contemporary observers?

Since the vessel went down fully provisioned for an ocean voyage, what can be learned about shipboard life during that era? Personal effects of the crew, implements for shipboard medical care and hygiene, cookboxes, bilge trash, etc., all help piece together this puzzle. The day-to-day living and pursuits of the ordinary seaman are probably the greatest blindspot in the understanding of early maritime behavior in any culture. The literature is extremely sparse on the subject even when dealing with major maritime nations with fairly predictable crew components. A vessel captained by an American born "merchant" with a polyglot crew in the waters of Micronesia should produce some very interesting material residues and insights into shipboard life. The archeological record from such a site could help in determining general signatures of maritime behavior that prevail regardless of the composition of crews or the functions of vessels.

MANAGEMENT OPTIONS

OVERVIEW

Depredation of the Utwa Harbor site by yachtsmen, military personnel, and others prompted the Governor of Kosrae to issue an order prohibiting diving on the wreck site. A useful analogy can be drawn to the situation that now exists in Florida, a situation that might be relevant to the future of Kosrae. Collection and treasure hunting activities have reached such proportions off the coast of Florida that even the ballast stones have been removed from what were once wreck sites; now they simply no longer exist. Every wreck found in Florida becomes to the public eye a "treasure ship" and as such is often quickly reduced to a hole in the sand by both the avocational and professional treasure hunter. For the present, unauthorized removal of the Leonora materials has been considerably slowed, however, with the limited resources available to the Utwa villagers and the fact that there is only one certified diver on the island to monitor the site, it may become increasingly difficult to control depredation of the wreck in the future.

A program which is active and highly visible in protection of resources has been found to be the most effective deterrent to looting and vandalism of cultural remains (Adovasio et al. 1980; Foster and Bingham 1978; Hoots 1976; Christensen and Clark 1978; and others). However, a critical aspect of the protection of shipwreck sites in particular is the legislative framework provided. Cockrell (1980),

Meenan (1978), and others have pointed out problems associated with jurisdiction over and ownership of wreck sites within the United States. Many of the problems now faced by various states and the federal government could have been avoided had the jurisdictional question been resolved.

Under the current state of affairs, based upon court decisions in Florida and most recently in Texas, there is at best, questionable legal protection for shipwrecks in state or federal waters. The notable exception is the USS Monitor, located within a marine sanctuary, and shipwrecks lying within the boundaries of national parks or monuments where clear legal title of the submerged lands have been afforded to the National Park Service.

An action by a United States District Court in Miami (Treasure Salvors Inc., v. Abandoned Sailing Vessel believed to be the Nuestra Senora de Atocha 408 F. Supp. 907, 909, S.D. Fla. 1976), threw into dispute the long-held belief that the Federal government could claim ownership of a shipwreck under the Antiquities Act of 1906, the Abandoned Property Act of 1870, or the Outer Continental Shelf Act, or that it was entitled to ownership of wrecks under "sovereign prerogative." "The United States District Court in the Atocha decision had not found that the United States could not assert sovereign prerogative over wrecks; . . . simply that the United States had not done so" (Cockrell 1980).

Model legislation for shipwreck management offered by Meenan as recently as 1978 and the legislation adopted by several states and U.S. possessions currently include a "give away" clause for excavation or "salvage." This usually takes the form of paying the salvor for services rendered by allowing them to retain a percentage of artifacts recovered. This ill-conceived approach to the management of shipwreck sites has no parallel in land archeology. Certainly no responsible archeologist today would accept a decision or advocate a position that allowed treasure hunters to excavate or "salvage" sites such as Cahokia Mounds or Mesa Verde for a share of the artifacts; yet the "salvage" of shipwreck sites for a percentage of the recovered material has become institutionalized in many areas. It is this blind spot in submerged sites management which has contributed materially to the crisis now faced by both the United States Government and many individual states in the protection and preservation of these rapidly diminishing resources.

England, New Zealand, Italy, Egypt and Israel, have clearly defined laws stating that objects of historic value are part of the public domain and as such are controlled by the state. The option of giving away artifacts has been removed, and indeed stiff penalties for artifact smuggling or unauthorized removal have been imposed. In the absence of such laws or the inability of a nation to enforce them, looting of sites underwater continues at an increasing rate worldwide.

The Federated States of Micronesia is in a unique position to formulate legislation to protect the archeological resources of their

nation and to create an atmosphere wherein bits and pieces of their cultural heritage are not given away to treasure salvors as payment for destruction of the past. The creation of national and state marine preserves or marine underwater parks for protection of both natural and cultural features is one option open to the FSM and the people of Kosrae State. The critical element in the enactment of park legislation may hinge on the issue of clear and legal title to submerged lands and all contents coupled with the unquestioned assertion of sovereign prerogative. Failure to act quickly in the development of long range plans or the implementation of ambiguous legislation may result in problems similar to those now faced in the United States.

OPTIONS FOR CONSIDERATION

No Action

Since the remains of the ship in Utwa Harbor have been benignly neglected for almost a hundred years with little adverse effect this would seem at first glance to be a reasonable course for future action. Unfortunately, in the past few decades, it has become increasingly more difficult to postpone management action on known shipwreck sites without adverse results. The fact that some attrition to the site in Utwa Harbor already occurred lends further support to this statement.

Should no action be taken, this decision should be made in light of the probability that a major historic resource will eventually be subject to increased impact from uncontrolled access. This impact is in

addition to the lost opportunity for establishing a strong precedent for maritime preservation in an area that could effectively become a model for the rest of Micronesia.

Limited Testing

Once a wreck site reaches a state of equilibrium, deterioration of the remains proceeds at a very reduced rate. Protection by silt cover, coral growth, oxidation/corrosion or encrustation of the artifacts has been afforded naturally by the main environment. If this relatively steady state is interrupted, the cycle of deterioration and equilibration begins again. The removal of a sand or silt cover exposes wooden remains to attack by marine organisms and removal of the encrustations or coral growth from non-organic remains exposes them to renewed oxidation and deterioration. Limited testing of the wreck site carries with it the responsibility for upsetting the balance which has preserved the Utwa wreck for over 100 years.

To some degree the effects of limited testing can be mitigated through careful backfilling with the river silt. Although covering the site would certainly speed up the reestablishment of a steady state, in this particular situation it is not known what the long term effects of such action would be. Exposure, mixing and aeration of the river silt and the addition of freshly deposited organic debris, would contribute to the introduction of new sulfate-reducing bacteria. These bacteria play a large part in the corrosion of metals, especially iron in salt water. The freshly deposited organic material in the river silt

would consume oxygen as it decays eventually recreating an anerobic environment, after a new cycle of degradation. Silt deposition would not be advisable as a protective measure for the coral encrusted areas, such as feature 1. The presence of silt there would effectively kill the coral which has protected that feature.

The adverse effects of a limited testing decision should be weighed against the potential knowledge to be gained and the value of this information for an increased understanding of the wreck or for use in an interpretive program.

One technique which may prove useful to limited excavation on the site would be to employ a caisson. The techniques of airlifting or dredging within the caisson has proven effective in areas of deep sand or silt (Lewis 1973). The basic technique is for a diver to excavate within the caisson and as it settles new sections are added on top of the first. Ultimately, the caisson will settle upon solid strata which supports the shipwreck remains.

The site can be grided and the caisson employed randomly to determine the location of principal features. As the testing proceeds the features can be delineated by the employment of additional caissons. The caissons can be left in place either temporarily until the completion of the test excavation, or permanently to allow visiting divers to view specific features. In the latter case, a clear plastic top can be placed on the top to prevent removal of artifactual material and silting of the caisson.

Full-Scale Excavation

The basic problem of complete site excavation is that the issue of disturbing wreck equilibrium, discussed in the limited testing option above, has been compounded by several magnitudes. All materials should be considered perishable and in need of conservation soon after exposure and immediately upon recovery.

The use of prop wash deflectors mounted on a large boat (e.g. 40 ft. with a 2 ft. prop) could be used to remove the silt overburden. This device is capable of excavating large areas in a few minutes, and with proper controls, can be the most efficient method of clearing the overburden from the site. The vessel must be securely anchored in a three or four point moor to permit precise positioning within the area. This site slopes away from the base of the coral cliff (from 35 to 40 feet depth) as a result most of the silt would probably resettle outside the area of main concentration, especially if excavation was conducted during on an outgoing tide. Once the site has been cleared of the sterile overburden, water dredges or circle jets could be used for more controlled excavation.

Full videographic and photographic documentation should be considered basic to excavation. Periodic photo mapping and plotting should take place at critical stages in the removal of the overburden.

Museum Display

Conservation of artifacts, particularly those removed from a marine context, is a time consuming, long term and expensive process and requires continual commitment of personnel, funds, and a facility to house the materials. The Swedish warship Wasa, raised intact in 1966, has been undergoing conservation since that date; estimates in 1969 of the final cost of restoration and curation of the ship's remains suggested a figure of 7.5 million dollars (McKee 1969). Even after final conservation measures are completed, the ship will have to remain under very strict temperature and humidity controls in perpetuity.

While the remains of the Leonora are not as extensive nor as intact as the 1400 ton Wasa, the process of conservation would be similar, though on a smaller scale, if a large amount of intact structure is recovered. An entire operation with full scale excavation and conservation involves several phases; research and examination, actual removal of materials, immediate field conservation, provisional laboratory conservation and environmental control, final conservation and restoration of specific pieces, preparation for exhibition and display, and long term monitoring and conservation of remains (Hamilton 1976). To some degree the extent of the commitment would be dependent upon the quantity of materials recovered and their eventual disposition, i.e., for museum display, or strictly for research purposes where cosmetic appearance is not as important so long as the materials have been stabilized.

While removal and display of a shipwreck at first glance is appealing, the long term expense and problems of museum curation, particularly in so remote an area as Kosrae, are enormous. Currently there are few conservation laboratories set up specifically to deal with the materials from a marine context. Of these, most are concerned with the materials gathered by the state, government, or educational institution with which they are affiliated. At present, most archeologists do not have the necessary expertise or training to handle conservation problems in the field. In addition, cultural material from shipwreck sites presents some of the most difficult problems confronted by a conservation laboratory. Specialists in the field of conservation of artifacts from a marine environment would have to be employed on Kosrae or the artifacts themselves shipped to a conservation laboratory willing and able to process them. Conservation of carefully selected small pieces from the Leonora obviously would not present the logistical problems or monetary expense that a major excavation and removal of materials would create.

The condition of the wreck itself must also be a consideration. The Wasa and other reconstructed ships were found largely intact. The Utwa Harbor site, based upon the Submerged Cultural Resources Unit's preliminary reconnaissance, can be characterized as a primary wreck concentration but not an intact vessel. Much of the remaining materials are deeply buried. Reconstruction of the wreck would most likely be limited and based upon a fair amount of conjecture. A ship model, using data gathered about ships similar to the Leonora, coupled with information gathered during a limited testing program, could satisfy the need to see a ship. This approach would protect the wreck site as well as

provide the people of Kosrae an opportunity to view their wreck in the near future.

Establishment of a Marine Park or Preserve

The establishment of an underwater park or preserve carries with it some positive benefits for the long term preservation of both natural and cultural features of the environment. The outside reef at Utwa represents nearly a pristine reef environment due to the islands remoteness and low visitation by divers. As pressure increases for exploitation of resources in Micronesia, unspoiled reefs will become highly prized by both the scientific and environmentally conscious communities. A marine park or preserve could serve to protect both the Leonora and a section of the fringing reef in perpetuity for the people of Kosrae.

A marine park represents a very fragile environment and visitor use can quickly accelerate into user abuse. One park in the Virgin Islands represents a case in point. Commerical boats carry tourists out to view the barrier reef and tropical fish either through a glass bottom boat or by donning masks, snorkels and fins. Unfortunately, the park and boat captains have allowed visitors to toss scraps of food overboard and have thus encouraged one particular species of fish faster than many of the others to multiply disproportionately. The slower fish have been forced out of their former habitats and the variability of marine life has been reduced, altering the very theme which was an integral part of the establishment of the park.

An underwater trail was established at this park to enhance visitor enjoyment. The trail is marked with signs, painted swimming pool blue. One visitor characterized them as 'sign pollution at its worst . . . ugly and obtrusive.' Further, the signs have created a trail for the snorkeler in such a manner that the same corals or areas are touched and grabbed literally hundreds of times a week. Trail maintenance on land is difficult at best, underwater it is more difficult and damage to coral heads irreparable. Permanent markers are not critical to the enjoyment of a nature trail nor are they needed in an underwater park. Plasticized, re-usable keys to the fish and corals, available on board the boats for use before and after snorkeling trips and for the use of nondiver visitors in glass bottom boats may be a preferable approach. Not only is maintenance of the underwater signs eliminated, damage to the corals by visitors reduced, but the ability to appreciate and enjoy the beauty of the environment is not compromised for the visitor by intrusive signs. A similar approach could be implemented for the interpretation of both the Leonora and the outside reef at Kosrae.

The conservation management employed at the Galapagos Islands is an excellent example of what can be accomplished. The Ecuadorian government requires that tourists be accompanied by trained guides and strict rules forbidding the disturbance of the environment are enforced. Rather than being admonished afterward, each visitor is initially made to feel personally responsible for helping to maintain the unique balance of nature found on the islands. Positive contact with visitors by park personnel reinforces this understanding of the need for conser-

vation and protection of all resources and has been demonstrated to be an effective management tool in National Parks in the United States.

In situ interpretation of the wrecksite, from a direct cost standpoint, would be less expensive than removal and museum display. A commitment of funding and personnel could be directed toward site interpretation, both in water and in a small visitor or museum display area, and protection against unauthorized removal of artifacts. Certainly a few diver/guides would have to be trained whose responsibilities would include the Leonora and the village interpretive center. Fortunately, the site is located where observation from the village is easy. Anyone entering the harbor or anchoring over the wreck could be seen and the appropriate official notified. After a severe storm and on a periodic basis, the guides could monitor the site for damage, vandalism, or exposure of fragile materials. With proper curatorial facilities and provenience control, a particularly vulnerable piece of artifactual material could be removed from the site and included in the visitor center as part of a museum display.

ESTIMATED COSTS

(Please note that there will in all cases be very gross estimations since there are so many variables (e.g. who does it, travel, amount of equipment contractor already owns).

We have assumed that all underwater equipment has to be rented in this estimate).

Limited Testing

Close resolution magnetic survey to guide placing of test units
(magnetometer rental):

200/day x 6 days (including shipping days) 1,200.00

Test Excavation - field phase:

Personal Services (salary per 2 weeks)

Archeologist 800.00

Archeologist 800.00

Diver 500.00

Diver 500.00

Boat operator 400.00
3,000.00 3,000.00

Room and board - 4 persons x 10.00 x 14 days 560.00

Boat Rental - 2 weeks 500.00

Rental high pressure pump and fittings
\$75.00/day x 10 days 750.00

Fabrication of necessary attachments
(special nozzles etc.) 500.00

Underwater photographic, videographic and
recording equipment, rental and film costs 3,500.00

Compressor rental - \$80.00/day x 10 days
(this figure is based on last year) 800.00

Tanks, regulators and miscellaneous personal
diving gear rental - \$25.00/day x 4 x 10 days 1,000.00

Report writeup:
2 archeologists for 3 weeks 2,400.00

SUBTOTAL 14,210.00

Travel and transport of equipment - highly variable
depending on who, where from and what equipment.
Ball park estimate for 3 people and necessary gear
roundtrip if from West Coast of U.S. 8,000.00

TOTAL APPROXIMATELY \$22,000.00

Additional for Full-Scale Excavation

Personal services (salaries) 60 days in field rather than 10 for personnel mentioned above additional	15,000.00
Additional person conservator/diver	3,200.00
Transportation for above	2,000.00
Additional per diem	2,800.00
Rental of excavation equipment in addition to testing equipment and extension of rental of the latter	5,000.00
Rental of excavation barge capable of 4 point anchoring - 60 days x-\$250.00/day	15,000.00
Dive boat rental - additional	1,500.00
Compressor rental (it would be necessary to purchase one since rental fees would be greater than cost). Additional	3,000.00
Necessary also to have back up as entire operation is dependent on compressors Additional	3,000.00
Photographic, videographic equipment Additional rental and film costs	7,000.00
Additional rental of diving gear and excavation control equipment - grids, etc.	4,000.00
Report writeup: Additional	<u>7,000.00</u>
TOTAL OF ADDITIONALS	68,500.00
Original costs for testing (including transportation) from above 22,000.00	<u>22,000.00</u>
Approximate cost of full-scale excavation not counting stabilization of materials	<u>\$90,500.00</u>

Stabilization of Materials Recovered, Conservation, Display

This is an area which is subject to a great number of variables. To provide some general ideas of the costs involved, a professional conservator should be asked to provide some very gross estimates. Costs should address stabilization (not including display) for most materials, from a 218 ton wooden vessel from a marine environment, e.g., representative timbers, representative metal components, artifacts, etc. Currently estimates for conservation of material from marine shipwreck sites runs from five or six times to eleven times the cost of excavation.

RECOMMENDATIONS

It is the recommendation of the Submerged Cultural Resources Unit that a three phase plan for management of the shipwreck site in Utwa Harbor be adopted. Each phase could be consecutively funded and put into operation without developing a major financial obligation for the succeeding stage.

PHASE I

Develop a long range protection and monitoring strategy immediately for the wreck site:

The wreck site is presently fairly well protected since it is easily observed from the village of Utwa and any serious pilfering or vandalism of the site could be prevented through the authority of the village chief. It is more difficult to prevent casual depredation by occasional visitors. In order to be able to judge whether such slow attrition is taking place it is necessary to have a baseline concept of what is there now. The information contained in this report should provide a useful control for measuring future changes including natural ones, i.e., siltation, storm effects. It is most important, however, that someone is designated the task of periodically diving on the wreck and noting changes over time. It would be most profitable if some members of the Kosrae Historic Preservation Committee could be taught to dive. Eventually, the creation of a marine preserve or park would pro-

bably grant the site and associated area the greatest degree of protection.

PHASE 2

Conduct limited test excavations on the site with only highly selective removal of artifacts:

Using procedures discussed in the management options section of this report, strip overburden from enough sections of the wreck site to more fully understand its extent and nature. Draw and photodocument timbers and large features in place but do not remove them. These test sections should then be quickly covered so that the disturbed biochemical equilibrium can be re-established as soon as possible. If instrumentation is available, a close resolution magnetometer survey should precede excavation, as it would provide excellent guidance for placing the test units.

Materials recovered from the test units should be small, easily handled and have definitive diagnostic value. It is essential that a funding commitment exist to stabilize and curate any materials removed before the first item is brought to the surface. It is just as important that a conservator is consulted before items are removed from an underwater context as after. The conservator's input will help the field archeologist understand what sort of stabilization costs would be incurred by removing wood timbers as opposed to iron fittings or copper sheathing, for example. The field archeologist can also be apprised of

the initial field treatment that should be given to materials removed from underwater sites.

The overriding theme of all research conducted during this phase should be a "conservation ethic." The researcher should be looking for maximum data retrieval from minimal site disturbance. This philosophy recognizes the fact that archeological excavations are destructive to archeological sites and total excavation is totally destructive. The knowledge gained, and the interpretive and display benefit derived from the material removed are all that mitigate the impact caused by excavation activities. It follows that with unique nonrenewable resources like shipwrecks it is particularly important to carefully assess each management decision that involves disturbance.

PHASE 3

Interpretive Display:

Completion of the first two phases in the recommended action sequence leaves the responsible officials in a position that an exhibit, museum, underwater trail or other visitor use attractions may be developed but are not necessary to avoid further attrition.

The categories of use could involve mobile educational exhibits for inland inhabitants and/or visitors, a fixed display area such as a small museum or an underwater interpretive trail.

It is possible that the latter may be a very powerful attraction for diving charters. The reef just outside of Utwa Harbor could be the focus of a very alluring natural equivalent to a cultural trail inside the harbor. The reef is magnificent in its beauty and is only a few minutes from the wreck site by boat. A visit to the reef where a deep dive was performed could be followed shortly thereafter by a shallow dive in the harbor on the wreck site. The combination would be a world class diving experience and could be conducted easily and safely from the village of Utwa.

In addition to any economic benefits realized it would also be an excellent mechanism for engendering a respect for the underwater environment by visiting and local sport divers, and a general appreciation for maritime history among the non-diving public.

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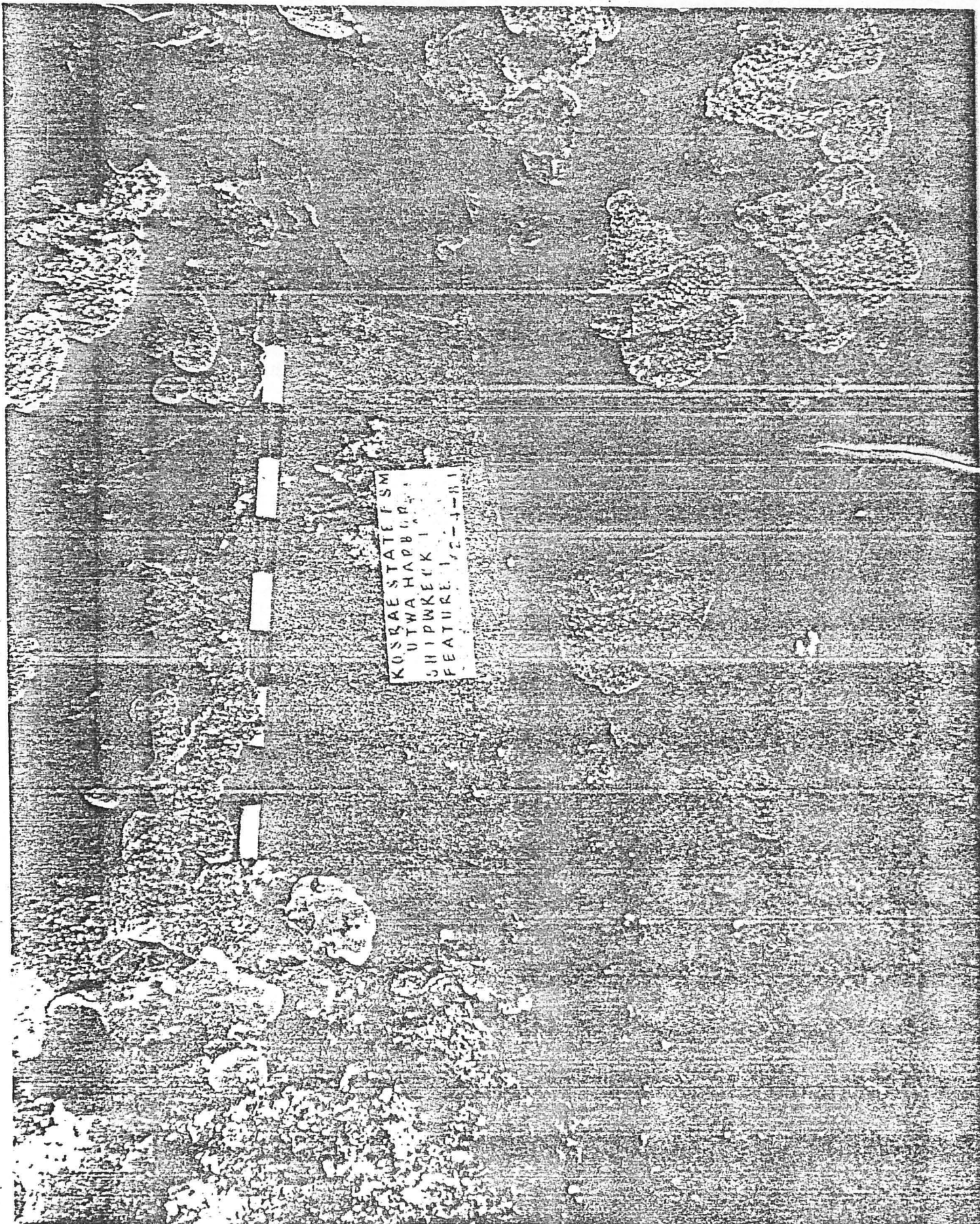


Plate 1: Feature 1

KOSRAE STATE PSM
UTWA HARBOUR
SHIPWRECK
FEATURE 2-1-1

STATE P.S.M.
STANLEY
SHACK 1
SHIPWRECK
FEATURE 4 2-4-81

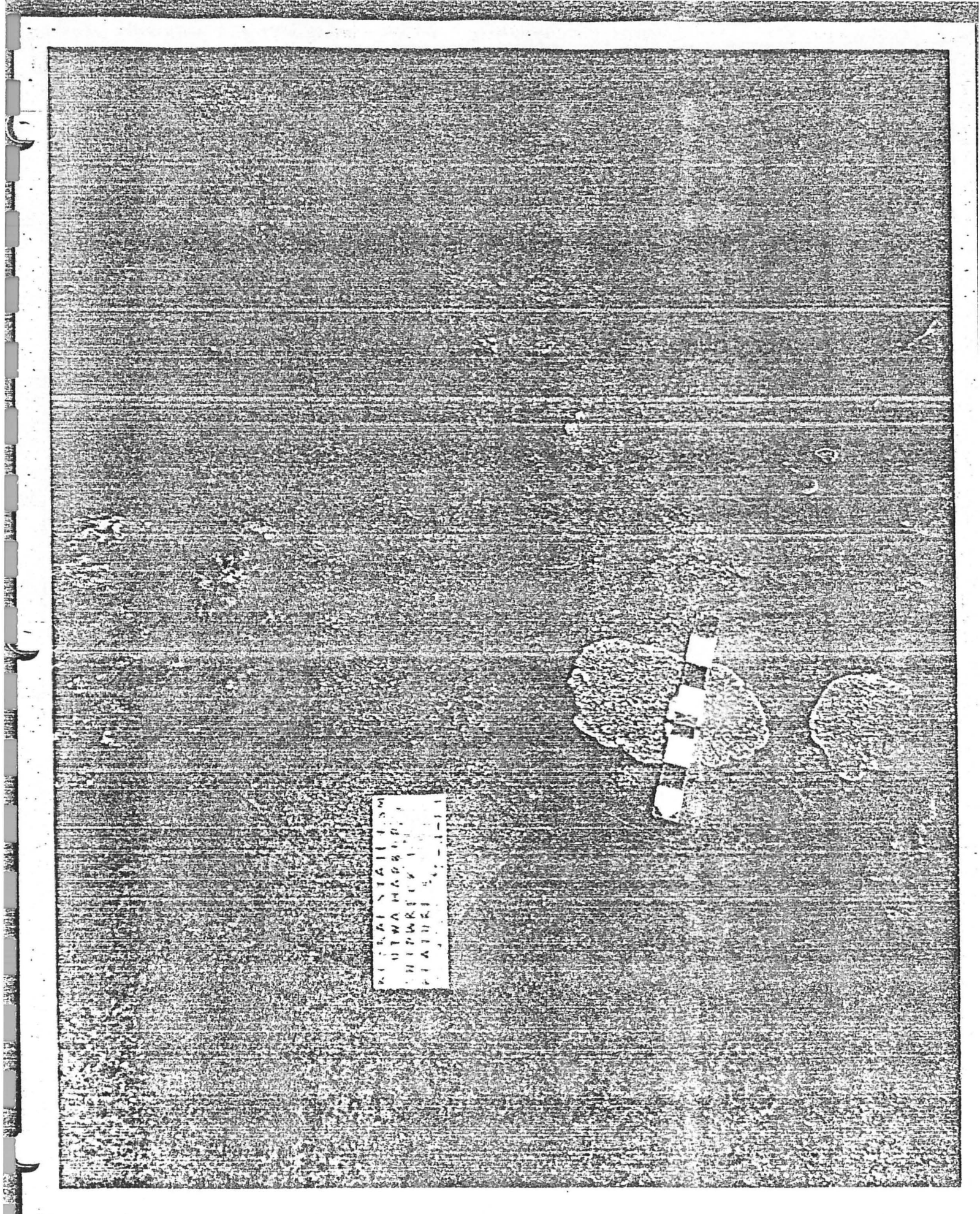


Plate 7: Feature 5

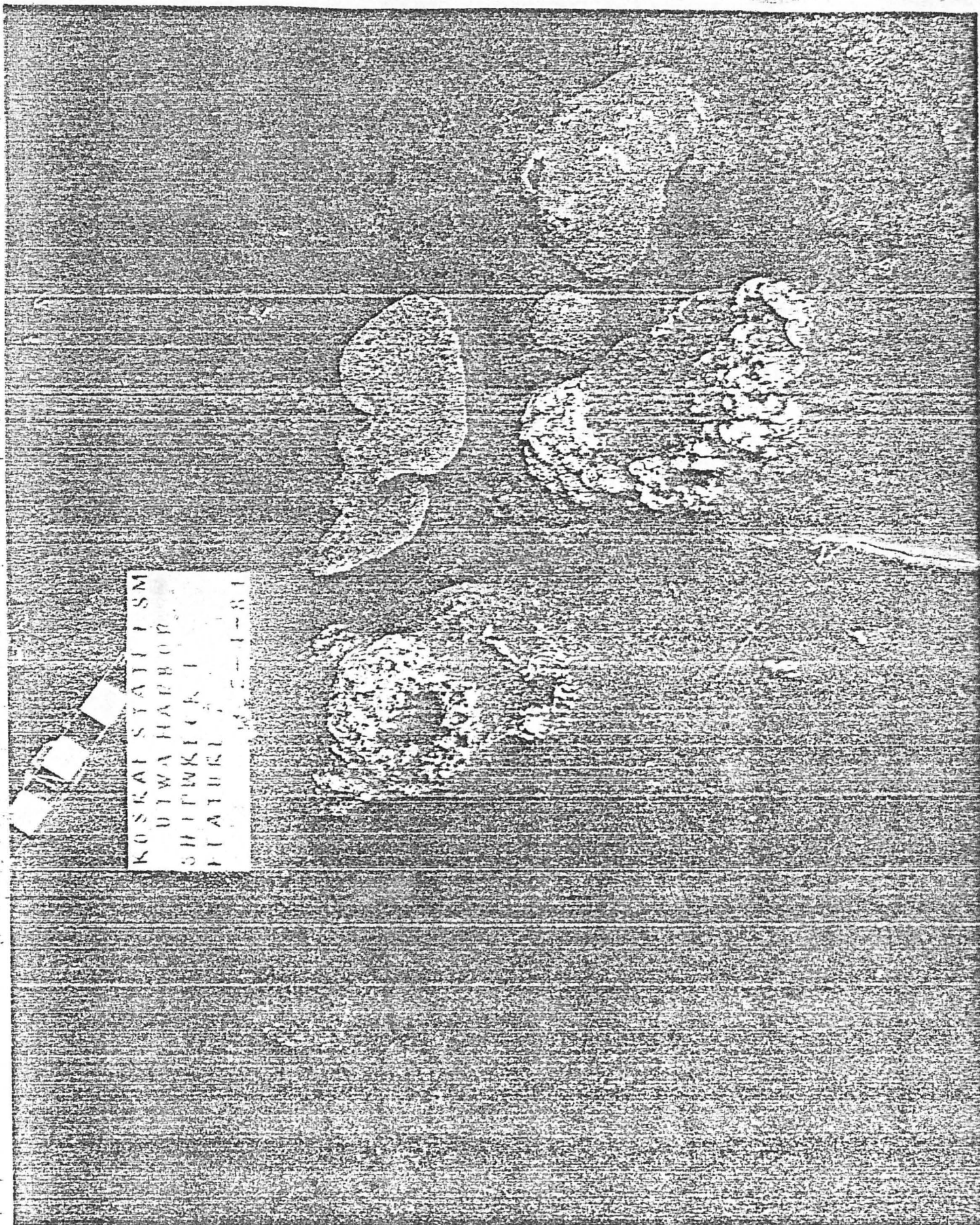


Plate 9: Feature 7

KOSRAE STATE (FSM)
UTWA HARBOR
SHIPWRECK
FEATURE 9

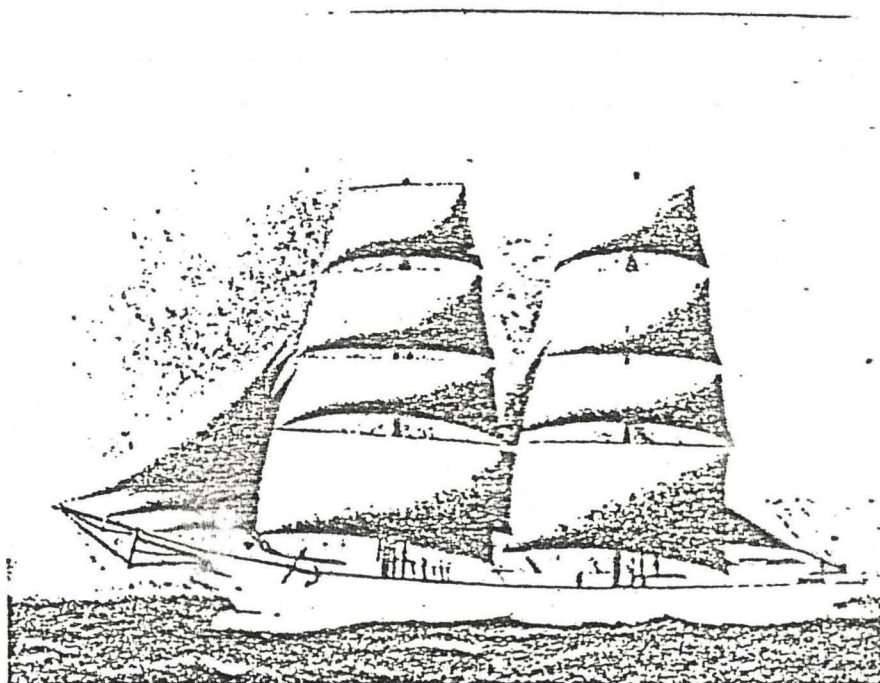


PRELIMINARY REPORT:
THE WRECK OF THE LEONORA
IN UTWE, KOSRAE

BY.

DR. PAUL M. EHRLICH

For The
HISTORIC PRESERVATION OFFICE
SAIPAN, CM.



The *Leonora* (formerly the *Pioneer*) at sea
From a contemporary sketch

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Mr. Harvey Segal, Director of Teacher Training for the Community College of Micronesia has been very generous with his knowledge of the wreck in Utwe. His own research into Bully Hayes and the Leonora on Kosrae originally located the suspected wreck. He also investigated the area where Hayes was supposed to have lived and worked in Utwe.

Father Francis X. Hezel, S. J. deserves special mention for permitting me to use the facilities of the Micronesian Seminar which has a fine collection of materials on Bully Hayes. Father Hezel has generously permitted me to cite his forthcoming manuscript "The Emergence of a New Order, The Close of an Era". His conscientious research and our personal discussions expedited my own research on the Leonora.

Dr. A. Grove Day has provided information and suggestions since the beginning of this study. His own work on Bully Hayes and Louis Becke has kindled much interest in the history of the Pacific Islands and laid the groundwork for later research.

Dakeo Syne, Head Librarian and Iris Falcam, Librarian of the Community College of Micronesia have permitted me to use the CCM Library Pacific Room and have been willing to assist wherever possible. Erwine Hadley has provided typing services. Finally, Akira J. Suzuki

allowed me to use a typewriter at the USO Ponape for typing initial drafts.

Objectives of this study:

The wreck of the Leonora is one of the well known events in the pre-colonial contact history of Micronesia. This is partly due to the reputation of the Leonora's master, "Bully" Hayes. Though Hayes had the reputation of being a "pirate", recent research shows him to have been a shrewd swindler, trader, blackbirder, and bigamist. Hayes's notoriety and rumors of treasure aboard the Leonora have given the wreck a certain mystique.

Irrespective of the rumors, the Leonora is a vestige of a period when there was no rule of law in Micronesia which could effectively govern the people of the islands and the outsiders who had begun to visit and trade in ever increasing numbers in the nineteenth century. At the time of the sinking of the Leonora, the pre-colonial period was assuming a tamer nature. Missionaries were solidly entrenched in the islands and interisland traders had a particular interest in maintaining peaceful relations with the islanders. Hayes, for all of the stories of his wild antics, was a serious trader with stations on Kosrae, Pingelap, Mili, and Ponape. He had at least two other stations in the Gilberts. It was in the process of checking these stations that the Leonora visited Kosrae in March, 1874. While anchored in Utwe harbor on March 15, 1874, a surprise storm with high winds sent the Leonora on the reef and then to the bottom.

The objectives of this study are to:

- 1) to complete a background study of the Leonora especially while it was under Hayes's command.
- 2) to determine the nature of possible remaining artifacts which may be located in the wreck or in its vicinity.

- 3) to assist members of a prospective dive team in their determination of the identity of an existing sunken wreck in Utwe harbor on Kosrae Island. It has long been suspected that this is in fact the wreck of the Leonora.
- 4) to increase efforts to promote the return of artifacts which have been removed from the wreck on at least two occasions.

In regard to objective number four, it should be noted that the stripping of wrecks is a common problem throughout Micronesia, especially in the Truk Lagoon. Fortunately, Kosrae has been relatively isolated, but on at least two occasions, artifacts have been removed from the wreck in Utwe.

In 1968, a research vessel of the Scripps Oceanographic Institute visited Kosrae to take water samples and temperature readings. They travelled to Lelu and Utwe harbors and, while in Utwe, dove on the suspected wreck of the Leonora. According to Harvey Segal, then a teacher supervisor on Kosrae, the divers brought up copper nails, pieces of copper sheathing, a number of ship's fittings and metal parts from the rudder. (Segal, 11/7/80). Although the divers located a cannon and began to bring it up, they accidentally dropped it back into the harbor before getting it aboard the ship. Although some of the copper sheathing and nails were left on Kosrae, the rest of the artifacts were taken by the divers.

A second group of divers, a private party, dove on the wreck in the early 1970's (the exact date is unknown). These divers brought up combs, necklaces, at least one lantern, a number of knives and other artifacts

according to Kosraean witnesses. They took everything with them as far as is known. Although other artifacts may exist, both the Scripps and Kwajalein dive expeditions resulted in a serious loss for Kosrae.

This study is divided into two sections. Section one is a background history of Bully Hayes and the Leonora prior to the wreckage on Kosrae. It is by no means a complete biography of Hayes, but is merely a summary of his adventures including his acquisition of the Leonora and his activities as captain and trader. It is drawn largely from the work of Frank Clune, A. Grove Day and James Michener, and Louis Becke. Primary source materials have been used wherever possible and some of these include letters from Benjamin Snow, a missionary of the American Board of Commissioners for Foreign Missions. Another important document is the report of the HMS Rosario which travelled to Kosrae to investigate charges against Hayes, in 1874.

Section two is an account of the wreck of the Leonora and the activities of Hayes and his crew afterwards on Kosrae. It includes information about Hayes's relationship with the people of Kosrae and possible locations of the wreck and other artifacts. Although the author is fairly certain that the existing wreck in Utwe is the Leonora, no positive identification has been made, and must await some determination by the dive team.

Section three includes a brief account of the death of Bully Hayes and descriptions of individuals who sailed with the Leonora and had descendants on Ponape and Kosrae.

SECTION I

Bully Hayes and the Leonora:

The Leonora first appeared in Micronesia bearing the name Water Lily.

She was a sleek 218 ton brigantine with two masts; she was square rigged with three jibs. Two different sketches of her have been located but neither gives sufficient close up detail to assist in identification. (See the following page).

According to A. Grove Day, the ship was originally built in Aberdeen for the Chinese opium trade. (Michener and Day, p. 213). In 1868, Ben Pease and C.A. Williams purchased the Water Lily in Honolulu. Within a short time Williams sued Pease for \$25,000 dollars. Pease found another partner, Glover & Dow of Shanghai which purchased Williams' interest. (Hezel, p. 7). Pease changed the name of the vessel to the Pioneer in 1868 or 1869.

Though Glover & Dow actually owned the vessel, Pease operated the Pioneer and the trading stations as he saw fit. The ship was armed, though the number of guns fluctuated depending upon the circumstances. At times there were as many as nine guns, but a U.S. Navy investigation in 1872 turned up none, despite allegations to the contrary. (Narragansett, 1872).

Pease deserted a whale ship on Ponape in the 1850's and had eventually bought land from the Nahnken of Kiti (Nanaua en Mwudok) in the mid-1860's. (Hezel, pp. 1-2). This happened to be right next to the American Board Mission Station in Rohn Kiti, which the Nahnken set afire and burned to the ground. Here Pease operated the Pacific Trading Company in concert with five partners. (Mahlmann, pp. 46-47). Generally, he bought trade goods in Shanghai and traded for coconuts, copra, and coconut oil in the Pacific Islands.

In March, 1870, Pease sailed to Apia, Samoa where he found William Henry ("Bully") Hayes. Hayes and Pease had known each other in the China

opium trade (Day, Becke, 106) but Hayes had drifted into the Pacific arena and was currently awaiting trial in Apia. Hayes was born in Cleveland, Ohio and learned his seamanship on the Great Lakes. Later he became a second mate aboard Atlantic packet ships in the 1850's. By 1853, he was master of the Bark Canton, first of the fifteen vessels which he commanded at different times. He was married four times and had the reputation of being quite a womanizer.

When Pease arrived in Samoa, Hayes was facing charges of stealing men and women from Manihiki. Despite the fact that he was supposed to remain in Apia, Hayes talked the American Consul Williams into letting him check out some chronometers aboard the Pioneer. That night, April 1, 1870, the Pioneer with Hayes aboard slipped quietly out of Samoa.

The two notorious captains blackbirded and traded together until 1871 when Pease was arrested on Guam and sent to prison in Manila. Hayes continued to captain the Pioneer and managed the trading operations in Pease's absence. In addition, Hayes operated his own stations independently. In 1871 he put a trader named Alfred Restiaux on Pingelap and persuaded the king of Pingelap to sign an agreement not to allow any Missionaries on the island for ten years. (Snow to Pogue, Oct. 7, 1871, ABCFM, 19.4, #258). On Kosrae, he formed a partnership with a French Captain Lechat to trade for beche de mer and coconut oil. According to one report, Hayes stole Lechat's schooner, the Neva. (Bar..., 1872).

By 1872, Hayes seems to have had sole command of the Pioneer. (Clune, 115). Pease was out of prison but living in the Bonin Islands, and he hesitated to emerge knowing that he was sought by both British and American authorities. Hayes visited Pease in the Bonins where they concocted a plan to buy the Pioneer from Glover & Dow and Company at a

very low price. Sometime between Hayes's visit to the Bonins and his arrival in Shanghai, copper sheathing was removed from the hull and the sails were "deliberately shorn". (Hezel, p. 13). Hayes thus arrived in Shanghai with the Pioneer appearing in dreadful condition and the crew lodging claims for back pay and accrued expenses. (Moss, p. 91).

Inasmuch as Glover & Dow were already facing immanent bankruptcy, they sold the Pioneer to Hayes for only £ 400, paid the crew, and bore the costs of refitting. They also authorized Hayes "to represent them in closing out Pease's trading stations." (Hezel, p. 13). This Hayes proceeded to do but he kept the receipts and sold the trade goods for his own benefit. Instead of taking the oil and copra which the stations had collected to Glover & Dow in Shanghai, he sailed directly to Samoa and sold it to the J.C. Godeffroy Company. After the Godeffroy agent, Theodore Weber, purchased the copra and oil, Hayes demanded an additional freight charge of \$2,500 as a condition of delivery. (Clune, 115). Weber was upset but he had no choice, having already paid for the goods he had to pay the added charges. Tricks such as this were characteristic of Hayes whose record of stealing ships and cargo was well known throughout the Pacific.

At this point, Hayes was in full control of the Pioneer which he had repainted white and renamed Leonora. The name was that of one of his twin daughters, Laurine and Leonora, progeny of his fourth wife Mary Emily Butler. The ship was in fine shape with new sails, a new copper bottom, and proper registration in Hayes's name.

After Hayes sold the copra and oil to Godeffroy, he had to submit to an investigation by U.S. Navy Commander Richard W. Meade of the U.S.S. Narragansett. Meade had been negotiating a treaty with a chief in Tutuila

but left when he heard that Hayes was in Apia. He sailed to Apia and arrested Hayes on charges of cruising with an armed vessel, ill treating natives, and ill treating crew members. (Clune, p. 116). After three days of testimony from members of Hayes's crew and others, Meade released Hayes on grounds of insufficient evidence. (Narragansett, 1872).

Hayes did have to settle one matter, back wages for his crew, but otherwise his papers for the Leonora were in order and he was free. Meade noted that the bill of sale was "regularly attested in the Consulate in Shanghai". (Narragansett, 1872). This meant that Hayes could sail without fear under the flag of the United States.

One additional element of Meade's report is important for this study and that is a list of stores and cargo aboard the Leonora on February 19, 1872:

- 1) Ballast: Stone, 50 tons; Iron, mostly scrap, 25 tons
- 2) Water tanks: of from 150 to 400 gallons; ship carried about 1100 gallons
- 3) Anchors: 2 in hold, 3 down
- 4) Hawasers: 3 of hemp, small (all old)
- 5) Casks: 30-40 - 31 tuns to a barrel
- 6) Sails: 1 suit topsails, 2 coarsco bent, 3 topgallant sails, 5 staysails, 1 bent main, 2 spencers, 1 bent, 3 headsails bent
- 7) Boats: 2 whale boats
- 8) 12 casks turtle and shark oil (600 gallons)
400 lbs. tobacco
2 chests containing combs, needles, thread, scissors, knives, cotton stuff, 600 yards of unbleached cotton stuff
- 9) Cabin: One medicine chest, charts, two clocks, one chronometer, one sextant, one box of drawing instruments, several nautical works, one aneroid barometer, one spy glass

(Narragansett, 1872)

According to Frank Clune, between 1872 and 1874 "the Leonora traded regularly between the South Sea Islands and San Francisco. She was frequently entered in with cargoes of oil and copra ... and cleared out in regular fashion. Hayes put himself fearlessly under the jurisdiction of United State courts." (Clune, p. 127). Hayes had his own trading stations on Kosrae, Pingelap, Mili, and the Gilberts. His center of operations seems to have been at Mili where he had a residence for his trader and a fourty square foot warehouse where he stored coconut oil, copra, coconuts, and turtle shell. These he sold "for gold money and trade goods, to the Captains of American and German vessels which called regularly at Mili." (Clune, p. 128).

There seem to be no stories of blackbirding on Hayes's part and in fact his dealings were those of a straightforward businessman with little of the chicanery which preceded his acquisition of the Leonora. This is not to say that Hayes never swindled again; he always took advantage of any circumstance as long as he could win and he rarely came out on the short end of any deal.

At the end of 1873, Hayes entered into a contract with MacFarlane and Williams in Samoa to deliver a ketch, the E.A. Williams to Mili for £ 500, payable in either copra or coconuts. (Clune, pp. 127, 128). On this venture Hayes hired Louis Becke to sail the E.A. Williams, while Hayes himself sailed the Leonora. This is somewhat surprising since Becke was only eighteen years old at the time. Nonetheless, Becke managed to sail the leaky ketch to Mili where he beached her (on orders from Hayes) for purposes of caulking.

This was the beginning of Louis Becke's association with Hayes. Though Becke later claimed that he sailed with Hayes for four years.

He actually did so for less than two months. (Clune, p. 129) (Day, Becke, TWAS, p. 107).

Following the Williams journey, Hayes took Becke along on a journey which was to end in the wreck of the Leonora on March 15, 1874. Though Becke claimed that he was Hayes's supercargo, Clune doubts that Hayes, the master and owner of the Leonora and her cargo would have even needed a supercargo. Instead he suggests that Becke was little more than a tally clerk. / In the official report of the HMS Rosario, Becke was described as a "passenger" and a "great friend of Hayes". (Rosario, p. 1674).

The entire crew consisted of eight plus Becke:

Will. Hayes -	American, Master
N. [Nils] Nahnsen -	Dane, First Mate
Will Hicks -	Fiji ½ caste, Second Mate
Jno Carston -	German, Seaman
John McDonald -	English, Seaman
Ah-So -	Chinaman, Carpenter
An-Ho -	Chinaman, Cook Steward
Bob -	Malay, Seaman
Louis Beck [sic]	English, Passenger

(Rosario, p. 1674)

This is considerably different from the picture of "a polyglot crew of thirty hard cases". (Day, Becke, TWAS, p. 112). Becke's tendency to exaggerate his own role and the events which surrounded his association with Hayes have cast doubt on his descriptions of events. However, he was definitely aboard the Leonora on her final voyage and his writings are the only first hand accounts of her sinking. Becke first wrote about those events in 1893, nearly twenty years after the Leonora went down, but the

story was first published by Thomas . . Brown "under the pseudonym of Rolf Boldrewood", and the title of the book was A Modern Buccaneer the bulk of which consisted of a manuscript by Becke. (Day, Becke, TWAS, p. 108). Another version of the wreck appears in the volume Ridan the Devil and other Stories (Philadelphia, Lippincott, 1899, pp. 281-295) with Becke as the published author.

SECTION II

The Wreck of the Leonora:

When Hayes arrived in Lelu, Harbor, at Kosrae Island on March 12, 1874 he found that five white men and islanders from Nauru (Pleasant Island) and Banaba (Ocean Island) were terrorizing the Kosraeans.. (Becke, "Wreck", p. 283). At this time the population of Kosrae was only about 400 people, a dramatic drop attributable to imported diseases in the early stages of white contact. The Nauruans and Banabans themselves were refugees from hardships on their own islands: the Nauruans had fled as a result of a clan struggle, and the Banabans sought relief from a famine on their island.

Apparently, the Tokosra (paramount chief) of Kosrae asked Hayes to help him rid the island of the new intruders. Hayes complied by first threatening to open fire on the houses and boats of the whites and the islanders. He then offered to take them to Eniweitok and Ujelang where they could live and make coconut oil. In addition they would have to resist "by force of arms, any attempt to take possession of the atoll by the German trading company of Godeffroy..." (Becke, "Wreck", p. 284).

On March 15, Hayes and the whites and their islander companions left Lelu to pick provisions at Utwe Harbor. They arrived in the morning and spent most of the day getting yams and pigs, and were preparing to leave when a storm began developing.

The Leonora was trapped in the harbor by two whaleships which were also anchored there.

Large swells were coming in through the harbor entrance and discouraged the captains from trying to put to sea.

As the sky darkened, Hayes ordered the crew to lower the royal and top gallant yards and to bring the small boats on deck. Though he had earlier ordered the Nauruans and Banabans below deck, he permitted them to come back up and abandon ship at will. Becke described a sky "as black as pitch" with high seas and "a strange humming note" which underlay the crashing surf at low tide. (Becke, "Wreck", p. 288). From the north-west Becke heard a "peculiar droning, humming sound, mingled with a subdued crashing and roaring of the mountain forest..." (Becke, "Wreck", p. 288). In the trade room, "liquor, powder, cartridges, concertinas, and women's hats were lying burst open on the floor". (Becke, "Wreck", p. 288).

Very quickly, the ship was swung around on its cable and started pitching violently in huge waves which sprayed across the decks. Becke wrote that he and half a dozen native women plus an Easter Island half caste girl named Lalia packed boxes with arms and ammunition. "In another chest we stowed the ship's chronometers, Hayes's instruments, and all the charts upon which we could lay hands, together with about six thousand silver dollars in bags, the ship's books and some silver plate". (Becke, "Wreck", p. 289). These they managed to get on deck and into boats which took them ashore through what must have been an impossible surf.

The violent motion of the ship loosened "the two guns on the starboard side" which ran to port and drove those on the port side "through the bulwarks". (Becke, "Wreck", p. 290). Six four hundred gallon water tanks were lost as they went "adrift on the port side". (Becke, "Wreck", p. 290). Hayes then ordered the crew to get ashore and shortly the ship was tossed

on the reef and the rudder was sent clean through the deck". (Becke, "Wreck", p. 293). Finally Hayes, Becke, Lalia, and a Nauruan woman named Karta managed to get ashore after being swept "over the stern" by a huge wave. (Becke, "Wreck", p. 294).

By dawn the storm had quieted and the crew and other survivors watched as the two whaleships sailed out of the harbor. Having ridden out the storm the captains "were, no doubt, very afraid that as 'Bully' Hayes had lost his ship, he would not be particular about taking another near to hand". (Becke, "Wreck", p. 295).

The wreck of the Leonora left Hayes and his crew stranded on Kosrae until they could get passage elsewhere aboard a passing ship. Hayes, enterprising as ever, arranged with the Tokosra to purchase coconuts and he set his crew and the Nauruans and Banabans to work making copra and coconut oil. (Clune, p. 130). Becke claimed Hayes persuaded the Tokosra to pay an indemnity of one million coconuts in return for items which had allegedly been stolen from the wreck by some Kosraeans. (Becke, CBH, p. 250). In fact, a published report of the HMS Rosario showed that the agreement was for 48,000 coconuts. (Rosario, Enclosure No. 16, p. 1678).

Hayes built a house in the area currently known as Utwe Ma (old Utwe). Hayes called the place "Maloe". From here he directed his copra operations for five months. Becke described considerable drunkenness and wanton murder among members of Hayes's crew and the Nauruan workers. However, it is doubtful that anyone was killed despite the rumors.

At one point, Hayes planned to leave Kosrae and to place Becke in charge of his goods and operations. Instead, he gave two beachcombers, living under Tokosra's protection, a compass, sextant, chart, sails, oars, provisions, water, and fifty dollars in cash, along with a document authorizing

them to sell the boat which they were to sail. Their mission was to carry news of the plight of Hayes and his crew to "traders and missionaries at Ponape, Pingelap, and Providence Island". (Clune, p. 131). They sailed off and contacted a ship to whose captain they sold the boat and disappeared. Shortly thereafter three vessels arrived within one week of each other on Kosrae: the Matautu (Sept. 15, 1874), Morning Star (Sept. 19), and the HMS Rosario (Sept. 22).

Hayes was delighted to see the first two ships and had a number of discussions with the American Board missionary, Benjamin Snow. Snow, upon hearing the news that Hayes was on Kosrae, had rushed from the Marshalls at the first opportunity in order to look into reports of Hayes's activities on the island. "I found Hayes and his company here, and on the whole things were in a more quiet and hopeful state than I feared." (Snow to Clark, Sept. 30, 1894, ABC 19.4, v. 4, #189). However, when the Rosario sailed in, Snow hoped to have Hayes forcibly removed from the island. The Captain of the Rosario, Capt. Dupuis doubted that he had sufficient proof to arrest Hayes and told Snow to get a strong letter from the Tokosra. (Snow to Clark, Ibid.). Though Snow got such a letter, Hayes escaped on Sept. 22. With Hayes gone, the best that Dupuis could do was to hold hearings and take testimony in Hayes's absence. The results later appeared as "Proceedings of HMS 'Rosario' in the South Sea Islands. Criminal acts of Mr. W.H. Hayes, Master of the Brig 'Leonora'." This was published in the Queensland Government Gazette on August 28, 1875.

When Hayes left Kosrae he gave Becke a handwritten note designating the latter "true and lawful attorney" of Hayes's property on Kosrae. (Rosario, encl. no. 15, p. 1677). He also left instructions to Becke regarding the disposition of the coconut oil stored at Maloe in Utwe.

(Rosario, encl. no. 16, pp. 1677, 1678).

Dupuis's investigation proceeded but produced no evidence strong enough to warrant Hayes's arrest. The only charge which could be supported was one of "cruelty to native girls" but Dupuis himself had doubts as to "whether the Sydney law would have been able to deal with such cases". (Rosario, encl. no. 2, p. 1674). Dupuis had the further restraint of attempting the arrest of an American sailing under the U.S. flag in the absence of evidence pointing to a major crime. In the end, Dupuis called Hayes "unprincipled" and "shrewd"; "yet it was impossible to find out much about him or his deeds. I was perfectly convinced that nearly the whole of the whites and natives were afraid to speak out". (Rosario, encl. no. 2, p. 1673).

Dupuis had little authority to arrest Hayes and neither did he have the ability to protect any protective witnesses against reprisals, in the event Hayes were to return. At their own request, Becke and five other crew members were permitted to sail to Australia aboard the Rosario. Interestingly, after the Rosario departed, Hayes returned on October 9 and presented himself to Snow as "a praying man". To Snow's astonishment, Hayes sought mercy and hoped to repent. So convincing was Hayes's new bearing that Snow wrote "I have met him several times since his return, and I have a growing feeling that the man is sincere, and fully determined on a new course of life." (Snow to Clark, ABC 19.4, v. 5, #190).

SECTION III

The End of Bully Hayes:

Hayes left Kosrae shortly after his surprising reappearance and made his way to Guam via Ponape. On Guam he himself was swindled in a deal to

assist the escape of some Carlist prisoners and he was arrested by Spanish authorities. Later in prison in Manila, he affected a convincing conversion to Catholicism and was released after nearly a year. After this he travelled to San Francisco where he procured a yacht known as the Lotus. Consistent with Hayes's record he managed to steal both the yacht and its owner's wife.

After sailing the Lotus to Hawaii and Samoa, Hayes continued on to Jaluit where he arrived on January 2, 1877. On March 27, 1877 the Lotus departed from Jaluit for Kosrae. Two nights later, Hayes became angry with his cook Peter Rietdyk for not being able to steer well in a "fresh wind and rough sea". (Young). Hayes threatened to throw his Dutch cook overboard but Rietdyk got away. Hayes called for a gun but the first mate and Mrs. Hecker delayed so Hayes went below to find it himself. At the same time, Rietdyk grabbed a boom crutch (two pieces of hickory bolted together at one end). When Hayes began to step up from the "companionway" "Dutch Pete" smashed his head with the boom crutch. The first mate, Charles Elson, came on deck and he and Rietdyk threw Hayes overboard. (Young). A few days later, the Lotus returned to Jaluit and a hearing was held. The evidence was sent to Washington D.C. but no action was ever taken against Peter Rietdyk since Hayes was considered an outlaw.

Notes on three men who were connected with the Leonora: John P. Eldridge, Nils Nahnsen, and Harry Skillings.

John P. Eldridge: Eldridge (from Barnstable, Mass.) originally captained the whaleship Harvest which was sunk in Lohd Harbor (Madolenihmw) in 1865 by the confederate ship Shenandoah. Eldridge remained on Ponape and worked for Ben Pease. He captained Pease's schooner the Malolo for two months in 1868. (Hezel, notes on Malolo log). He was a beachcomber on Ponape but sailed with Hayes on the Leonora. This is known from the Narragansett report of 1872. He joined the Leonora in September, 1871 and was aboard at the time of the Narragansett investigation on February 29, 1872.

Eldridge must have returned to Ponape because he was not a member of the crew when the Leonora sank in Kosrae. A number of Ponapeans still retain his family name "Eldridge". He is credited with building a wharf which still exists in Lohd.

Nils Nahnsen: According to the report of the HMS Rosario, Nahnsen was first mate at the time the Leonora sank. The captain of the Rosario put him in charge of Hayes's belongings on Kosrae.

Nahnsen was Danish. He married a Gilbertese woman and had a daughter, Jane. Jane was raised in the Marshalls by a German sea captain and moved to Ponape late in the German period. She settled in Nett, married a Japanese. She died in 1979.

Harry Skillings: Skillings was one of the five white men who were on Kosrae with islanders from Nauru. Various reports describe him him as a handsome man who had four Nauruan wives. He had planned

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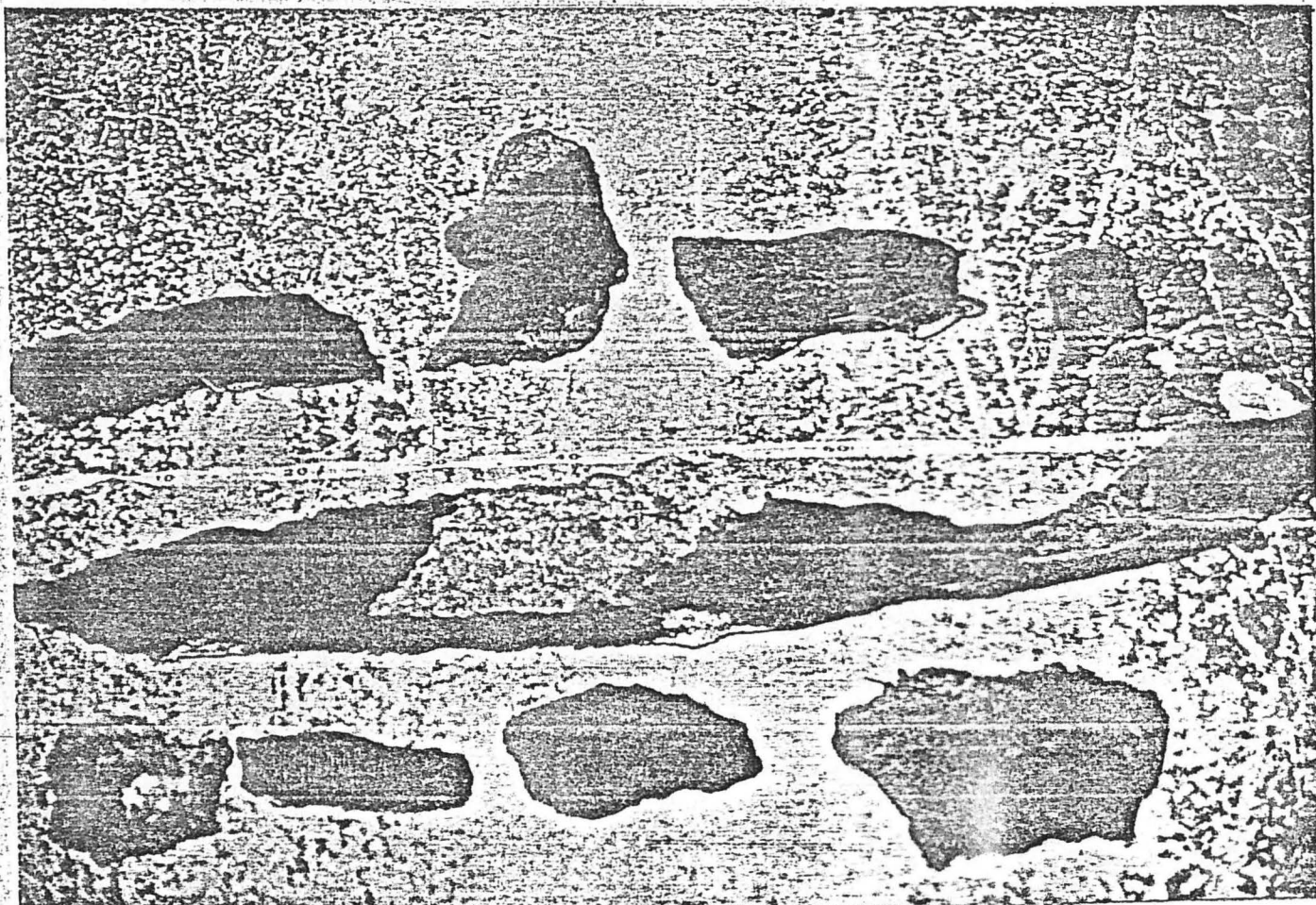
PHOTO SUPPLEMENT TO A REPORT ON THE
SHIPWRECK SITE PRESUMED TO BE THE LEONORA,
UTWA HARBOR, KOSRAE, FEDERATED STATES OF MICRONESIA

Adrian A. Winkel, High Commissioner of the Trust Territories of the Pacific Islands, requested the assistance of the National Park Service, through Director Russel Dickenson, for a preliminary assessment of a shipwreck site in the Utwa Harbor, Kosrae. As a result of this request a cooperative agreement was signed between the National Park Service and the Trust Territories of the Pacific Islands. Three archeologists, comprising the Service's Submerged Cultural Resources Unit, were directed to evaluate the wreck site and offer management suggestions to the Trust Territories Historic Preservation Office in Saipan.

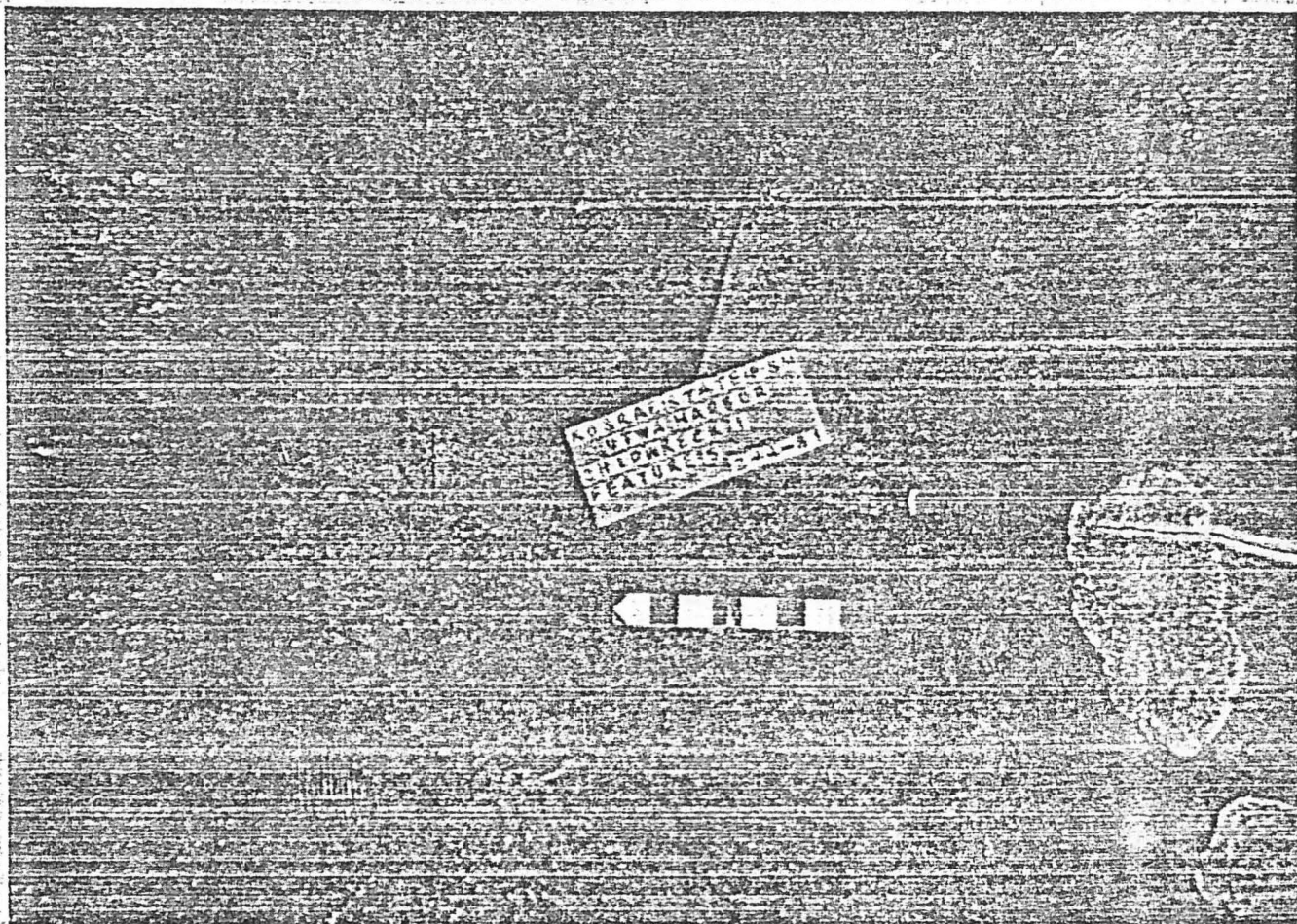
Unit personnel spent 8 days, January 31 through February 7, 1981, mapping, photographing and videotaping the wreck site suspected to be the Leonora, captained by Bully Hayes, which sunk in Utwa Harbor in 1874. An overview of the activities undertaken by the Unit personnel while in Utwa and a preliminary view of selected features of the wreck site is represented in the following photographs, slides and an artist's sketch map of the site. This is a supplement to the final report currently in preparation; it is submitted in partial fulfillment of the cooperative agreement.



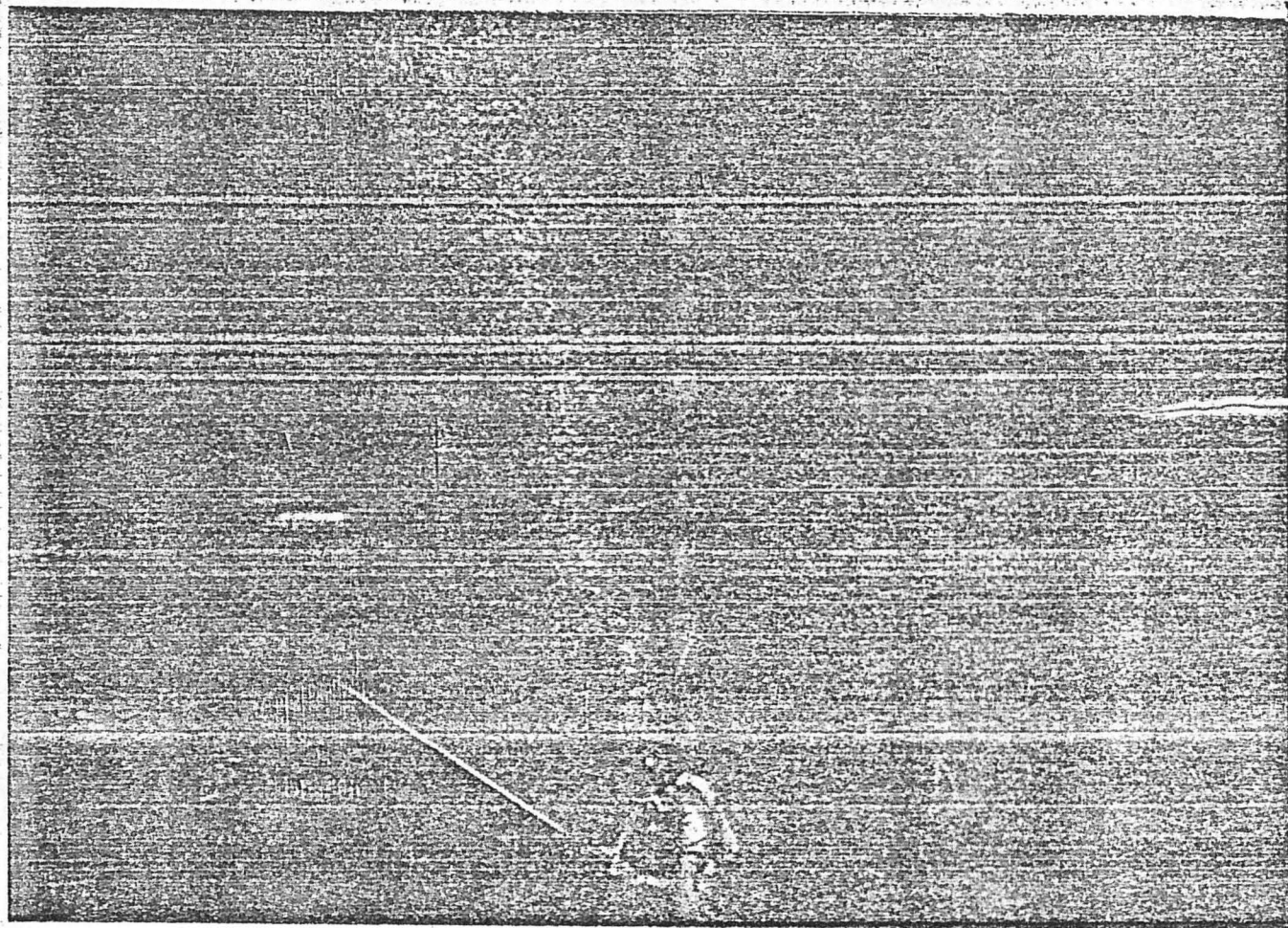
Kosrae State Historic Preservation Program Coordinator, Teddy John, points out the general location of the wreck site in Utwa Harbor.



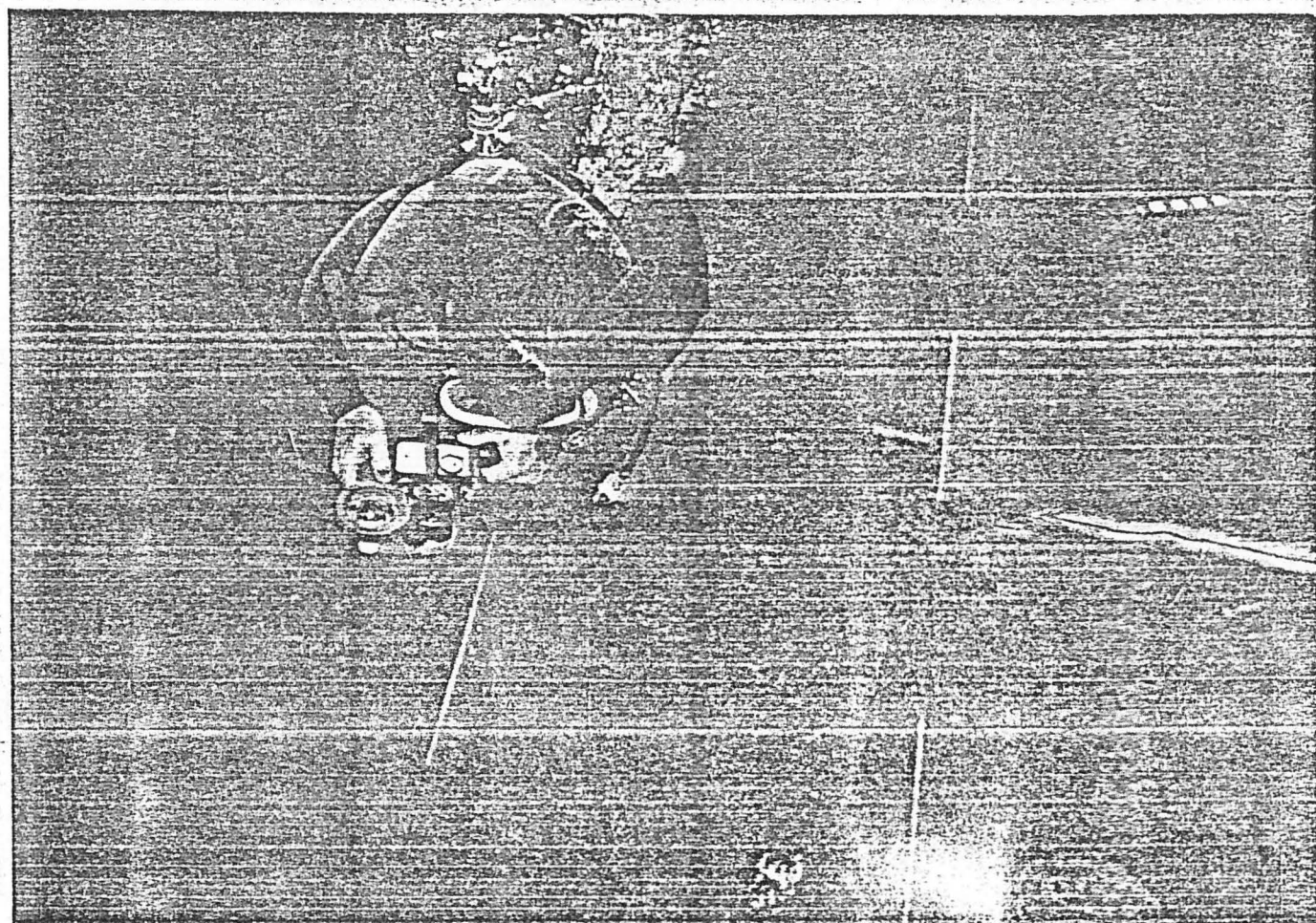
Immediate conservation of ferrous artifacts removed from a marine environment is necessary in order to prevent rusting, flaking and spalling of the surface. This heavily encrusted iron strap shows signs of deterioration following unauthorized removal from the shipwreck.



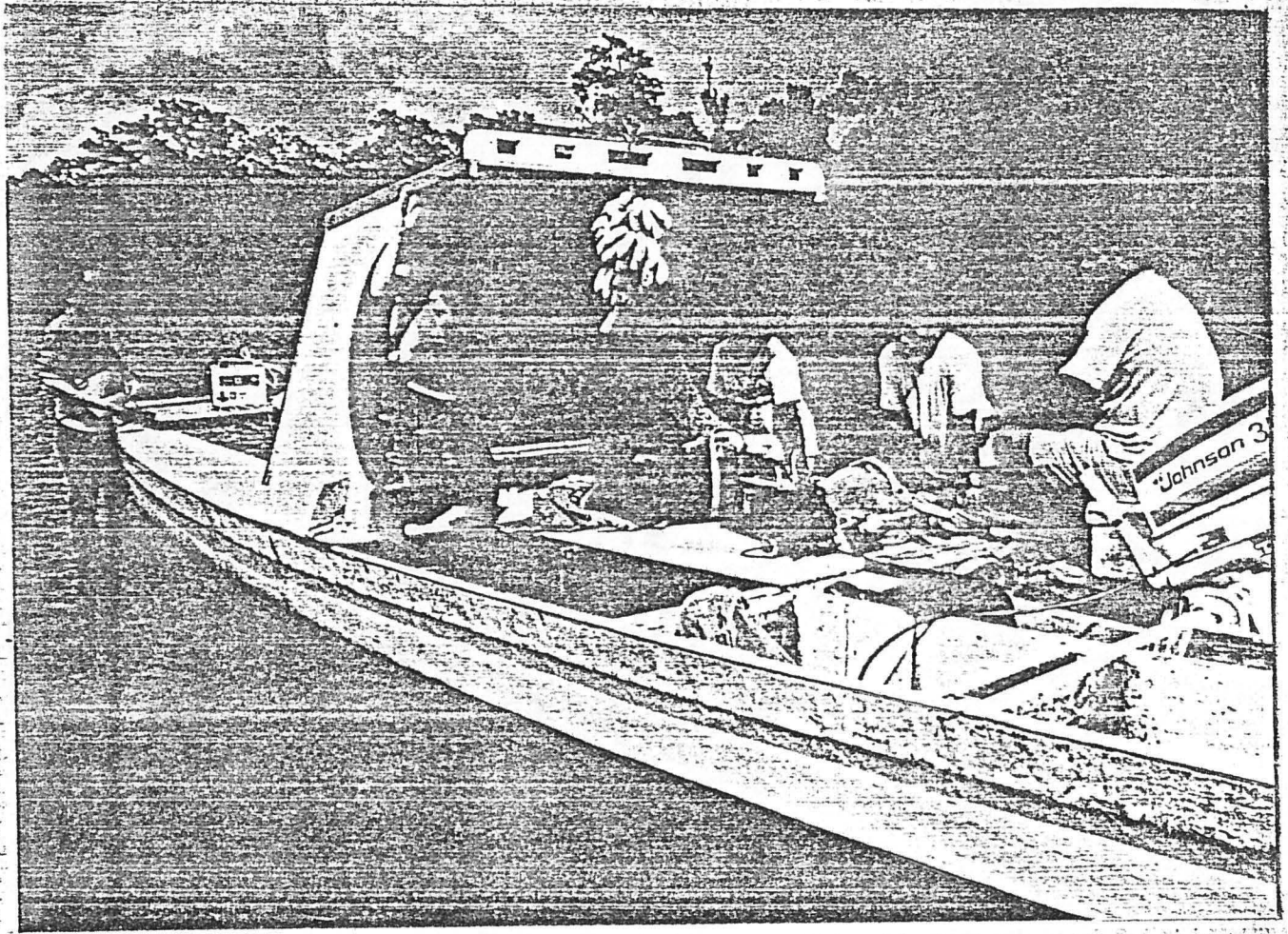
This view of Feature 5 contains articulated sheathing in situ along with an unidentified iron piece partially buried by a coralhead. Nails and nail holes form readily discernible linear patterns.



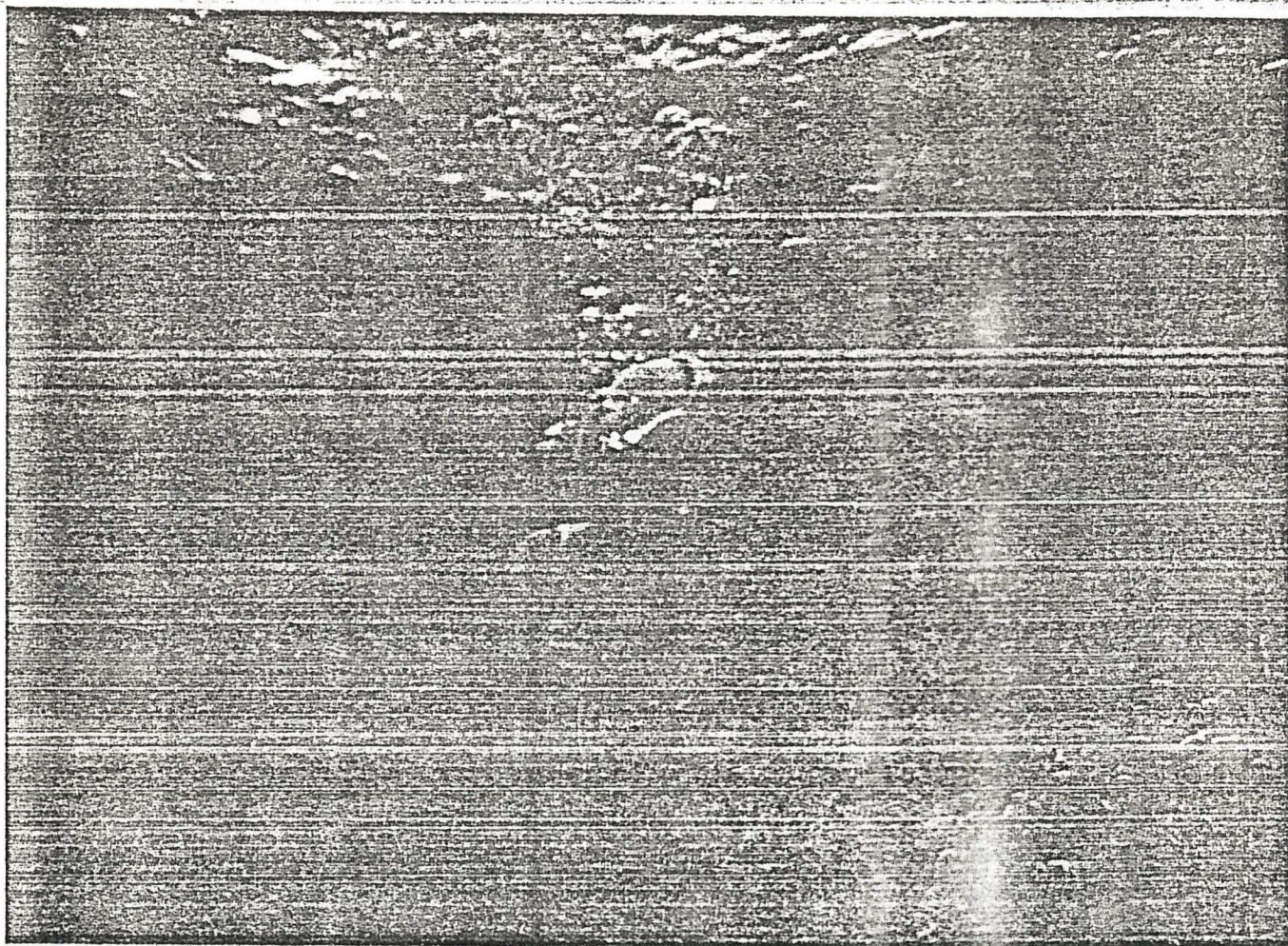
Triangulation off a pre-marked baseline was the mapping method used by the Submerged Cultural Resources Unit to plot the scattered areas of wreckage. This information was recorded on-site and later transferred to a plan map.



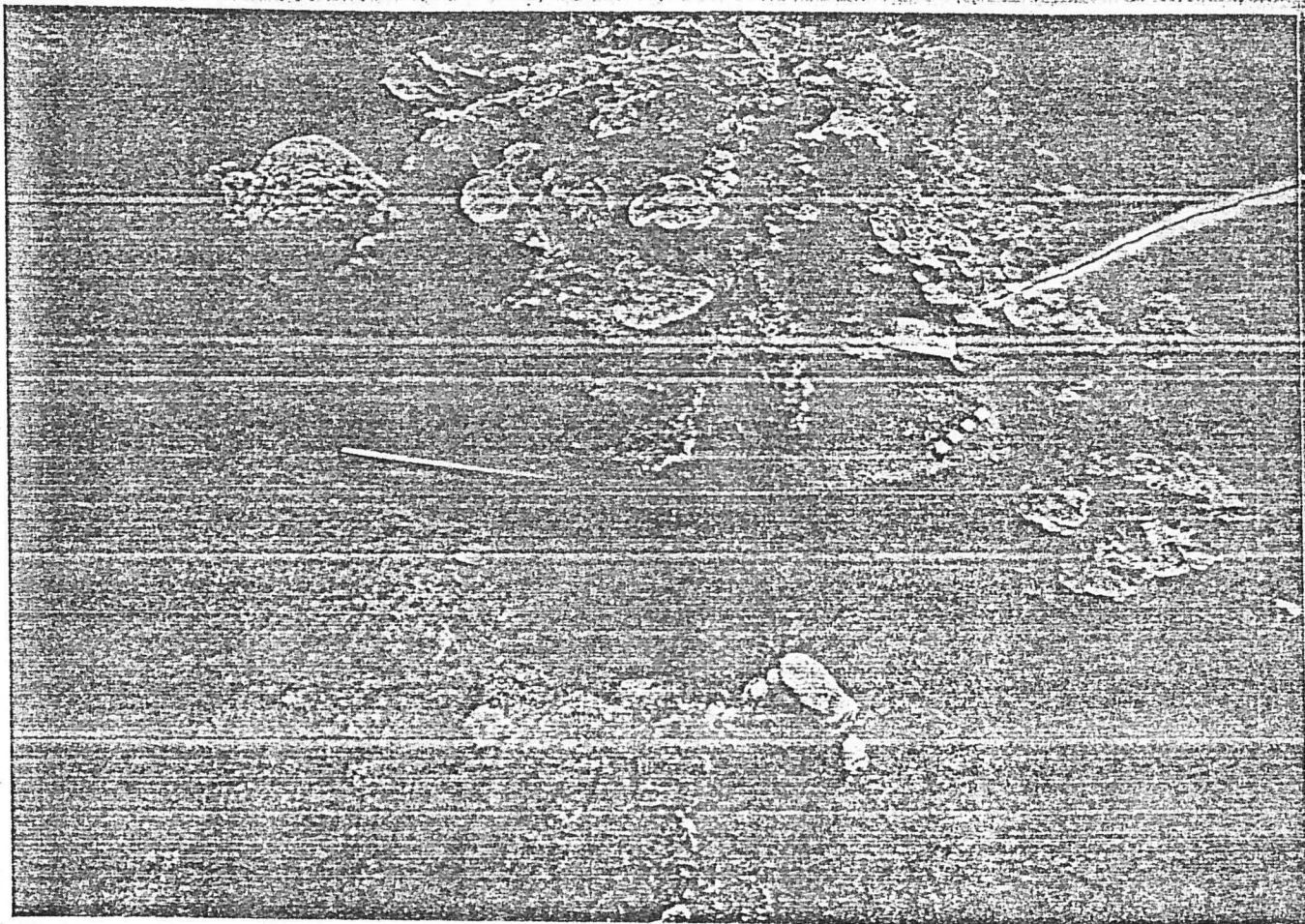
A semi-controlled photomosaic, using both black and white and color film, was undertaken for use as a baseline of site condition and relative positions of wreck materials. Here Larry Murphy levels the camera over the mosaic lines.



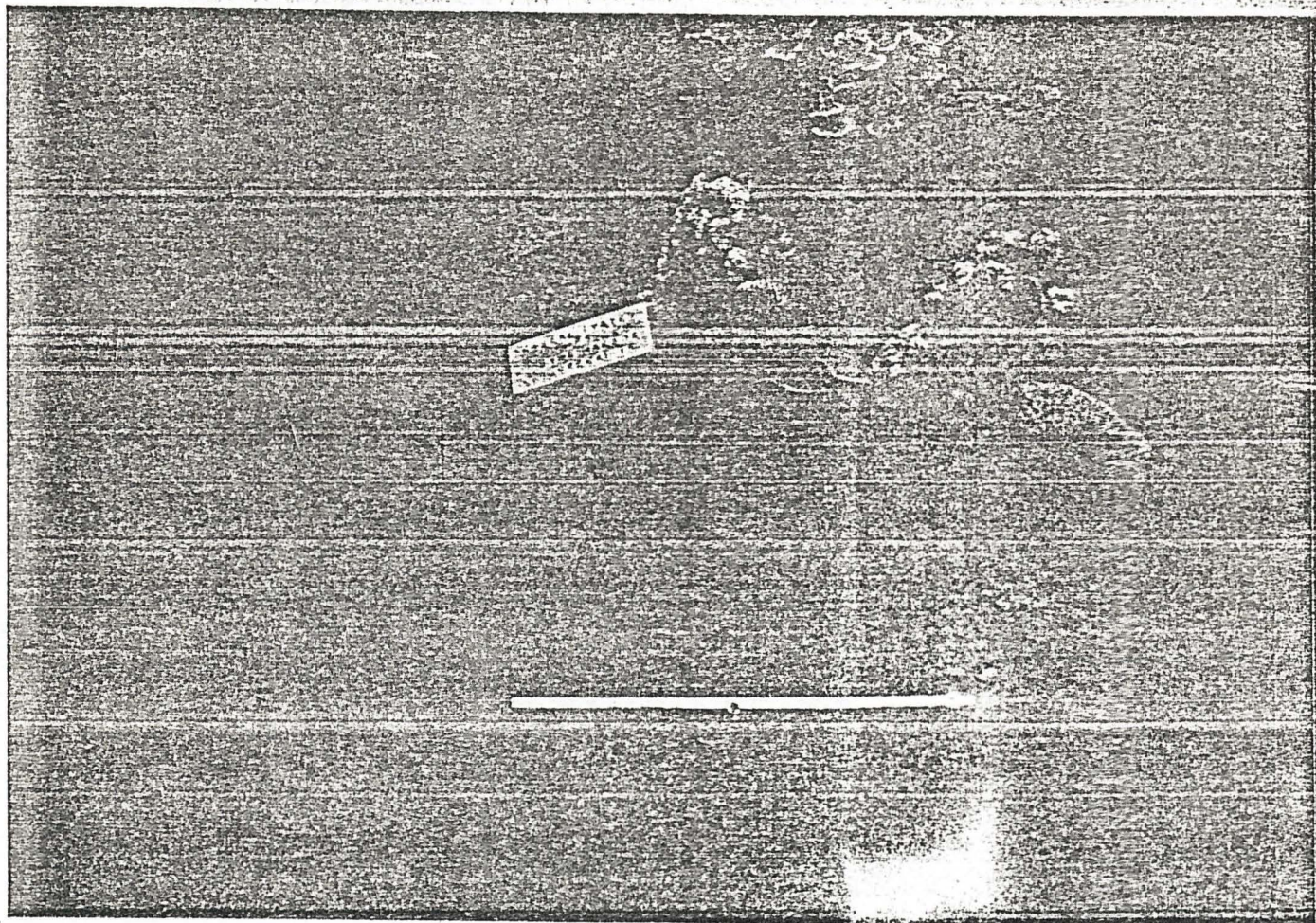
A twin-hulled fishing boat was used to transport people and gear out to site. Tomi Carrell (center) is setting up and pre-testing the video equipment while Dan Lenihan, Teddy John, Julian Jonah and Marston look on.



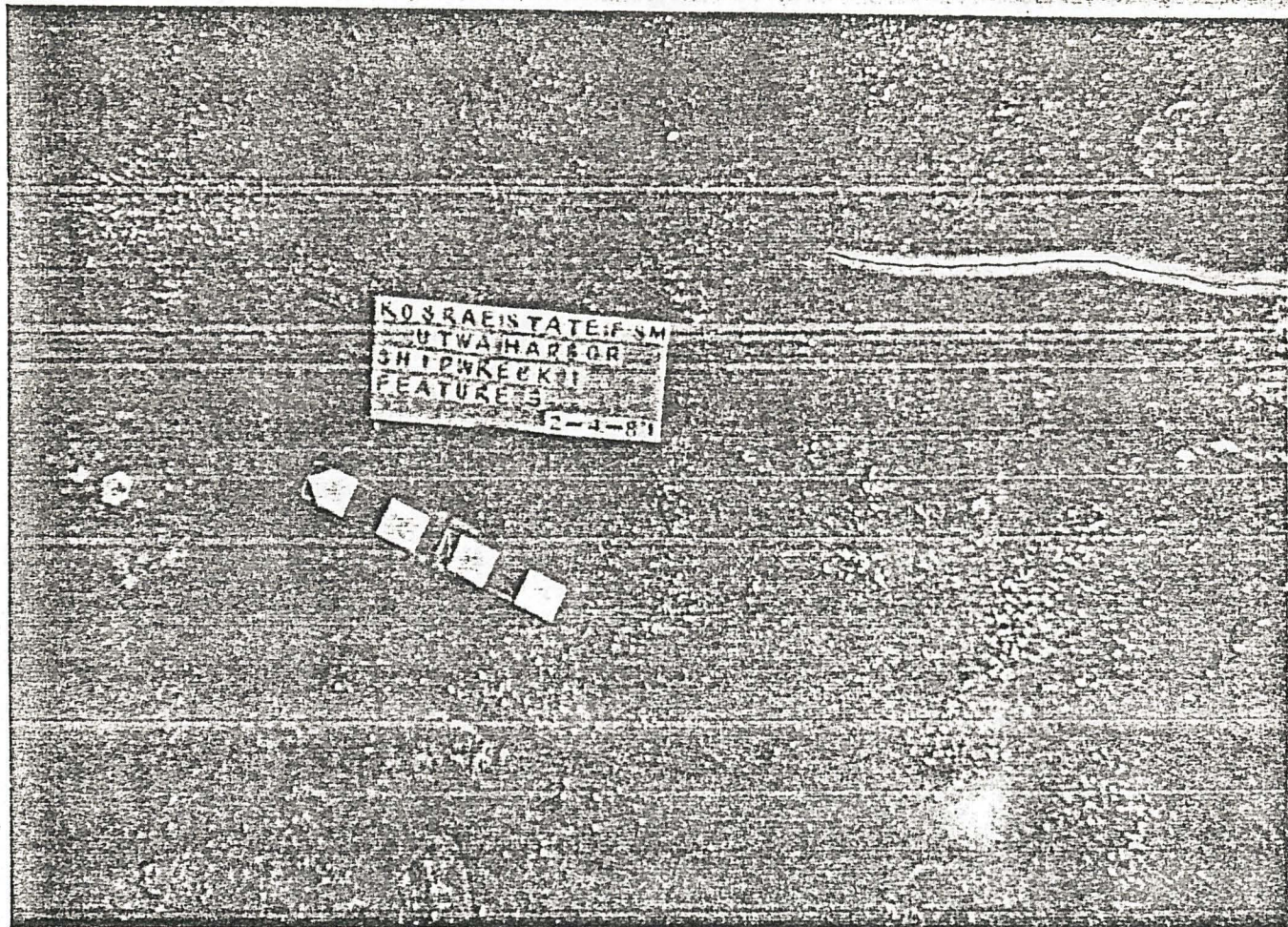
Obtaining a videotape of the wreck site was one of the objectives in the site evaluation. This tape was used later by the Submerged Cultural Resources Unit to supplement field notes and review the condition of selected artifacts.



A prominent piece on the wreck site was Feature 1, a large, copper sheathed, rectangular structure partially buried by coral growth.

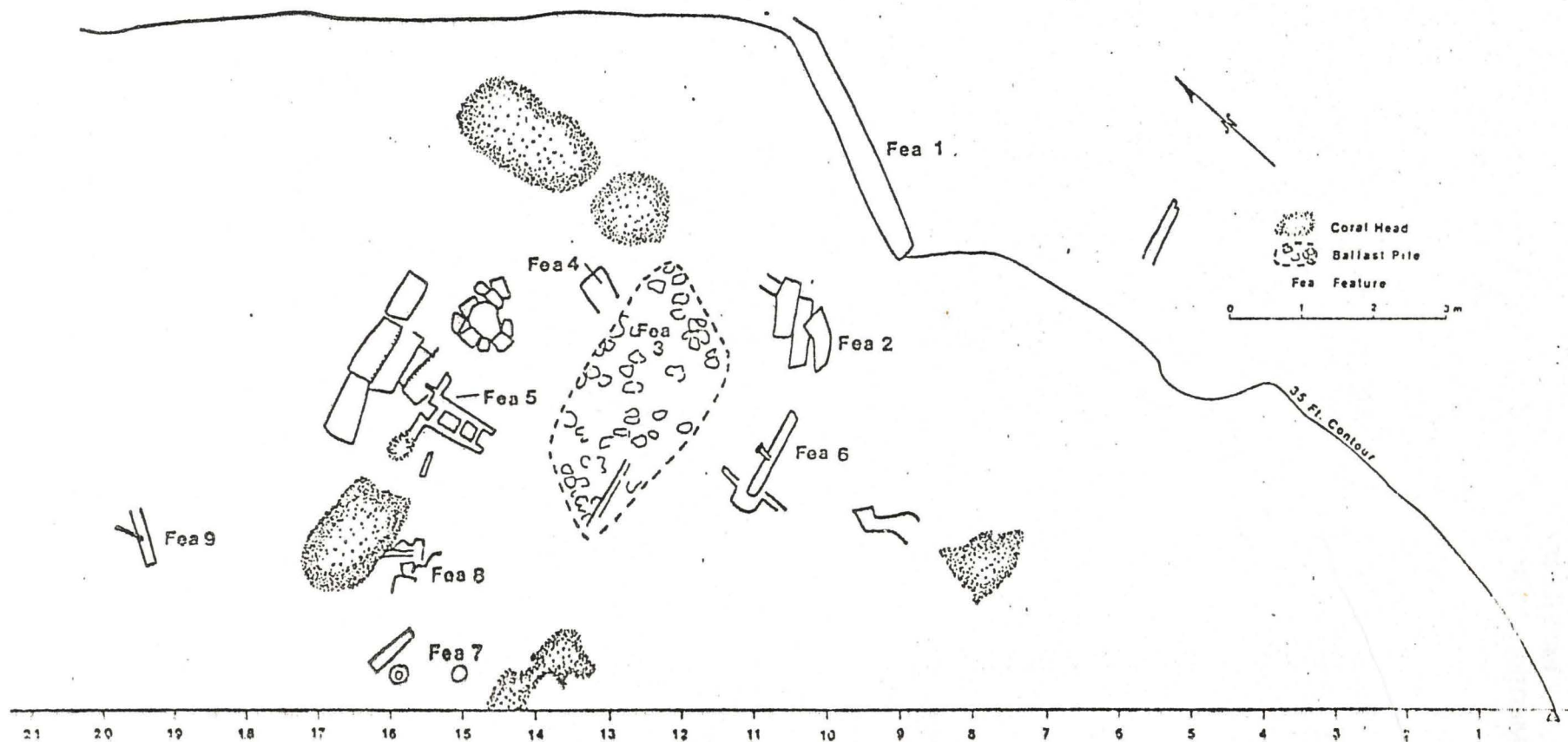


Feature 7: Two heavily encrusted uprights partially buried in the river silt. The sedimentation from the river, over 2 meters deep, may have acted as a preservative, sealing much of the wreckage off from depredation by visitors and deterioration from marine organisms.

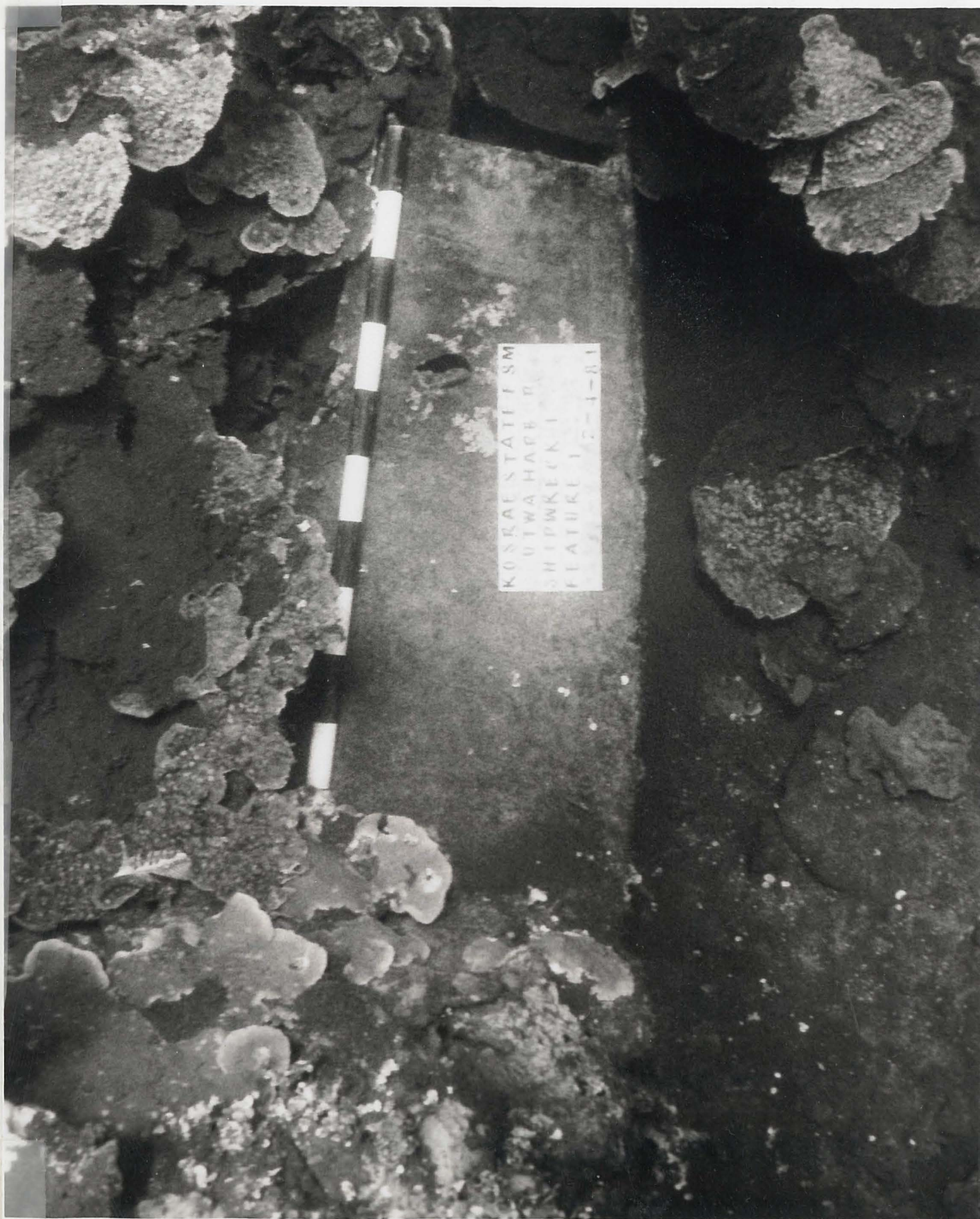


A large concentration of rock ballast was designated as Feature 3. The ballast was clearly in evidence and not buried by river sediments.

UTWA HARBOR WRECKSITE



to travel on the Leonora to Eni . itok but made a journey as far as Utwe aboard the vessel. After it sank he remained on Kosrae and fathered a number of children. There are today many descendants named Skilling on Kosrae.

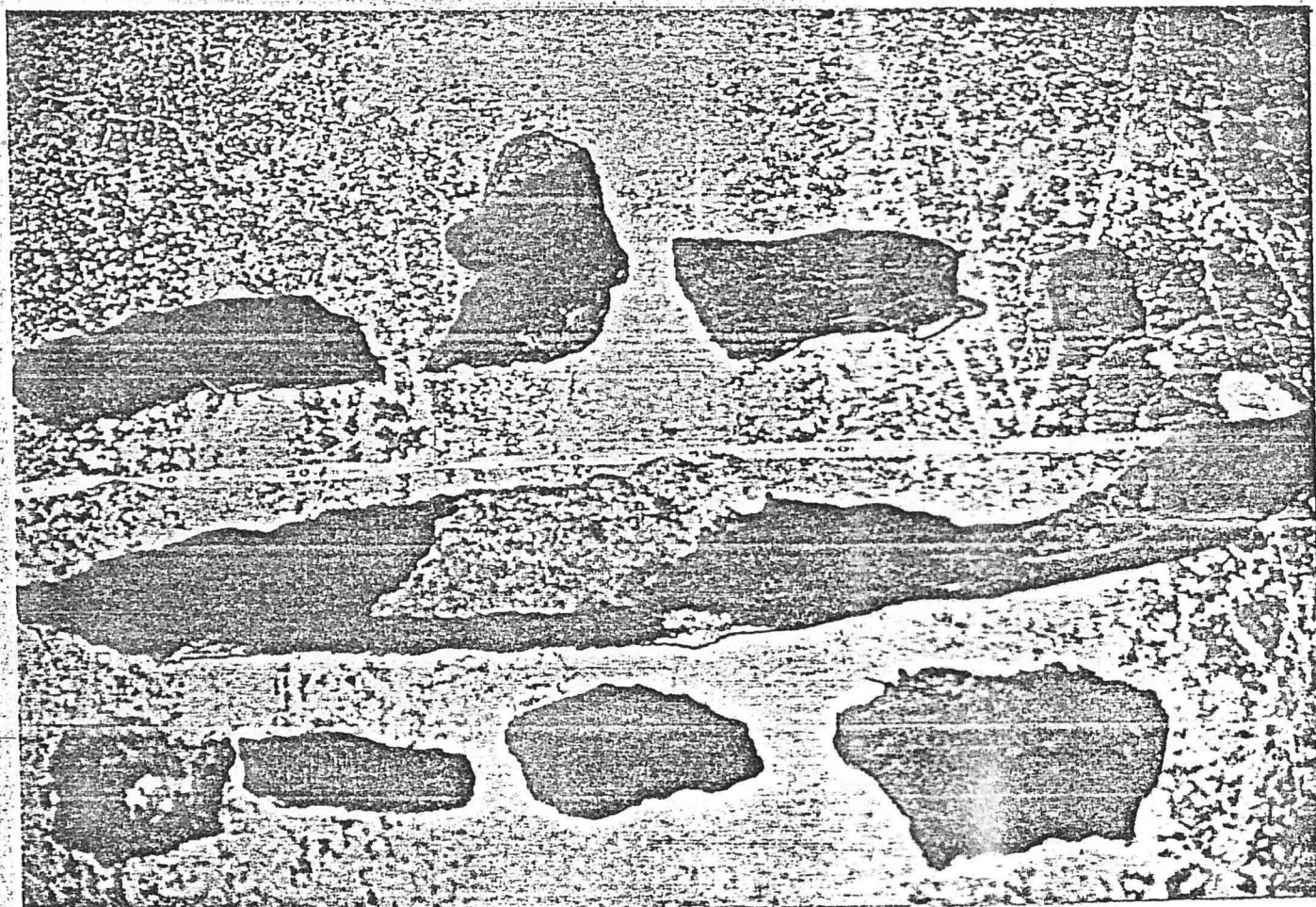




Kosrae State Historic Preservation Program Coordinator, Teddy John, points out the general location of the wreck site in Utwa Harbor.



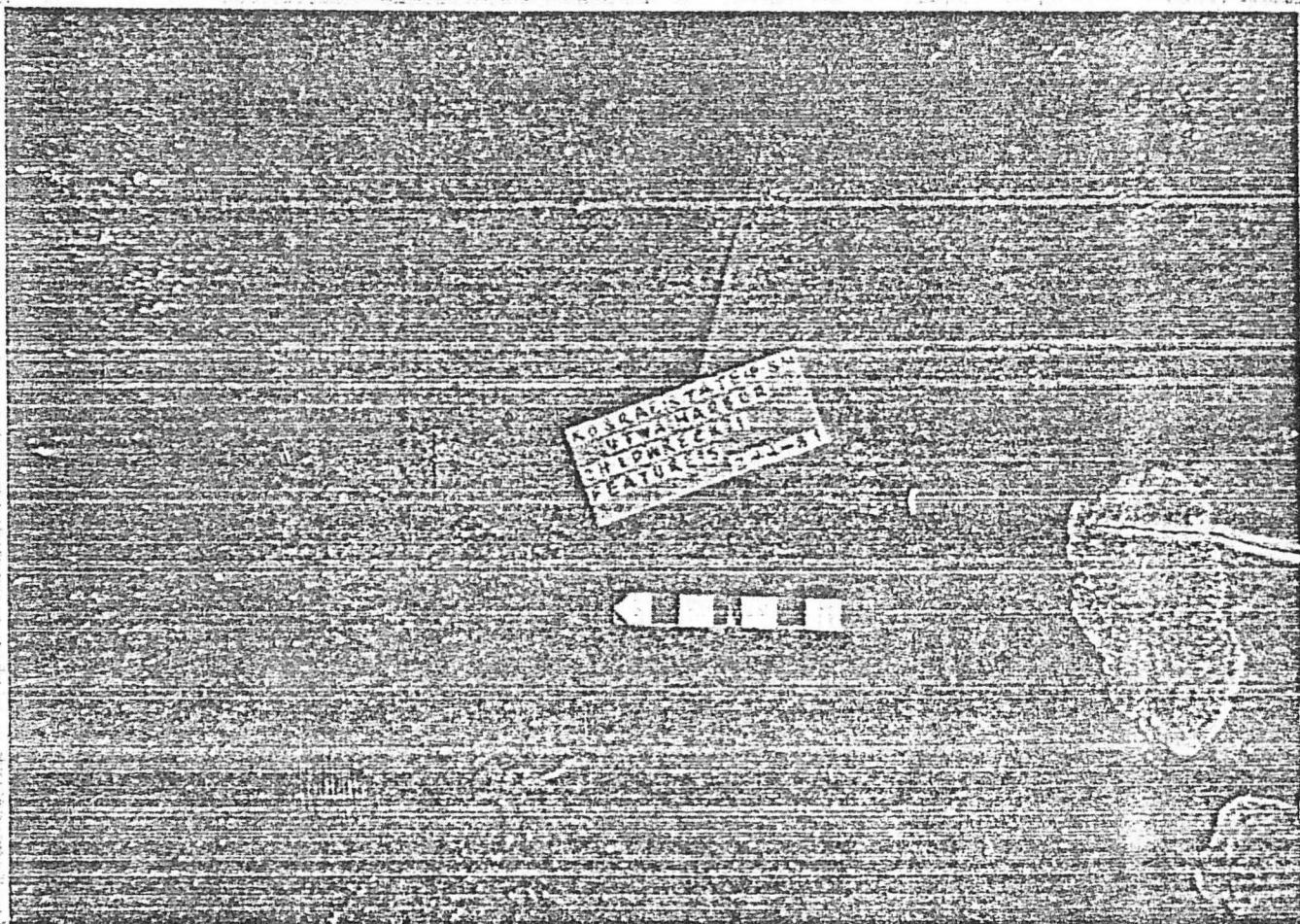
Daniel Lenihan, Chief of the National Park Service Submerged Cultural Resources Unit, records measurements and sketches the artifacts removed from the wreck site by divers.



Immediate conservation of ferrous artifacts removed from a marine environment is necessary in order to prevent rusting, flaking and spalling of the surface. This heavily encrusted iron strap shows signs of deterioration following unauthorized removal from the shipwreck.



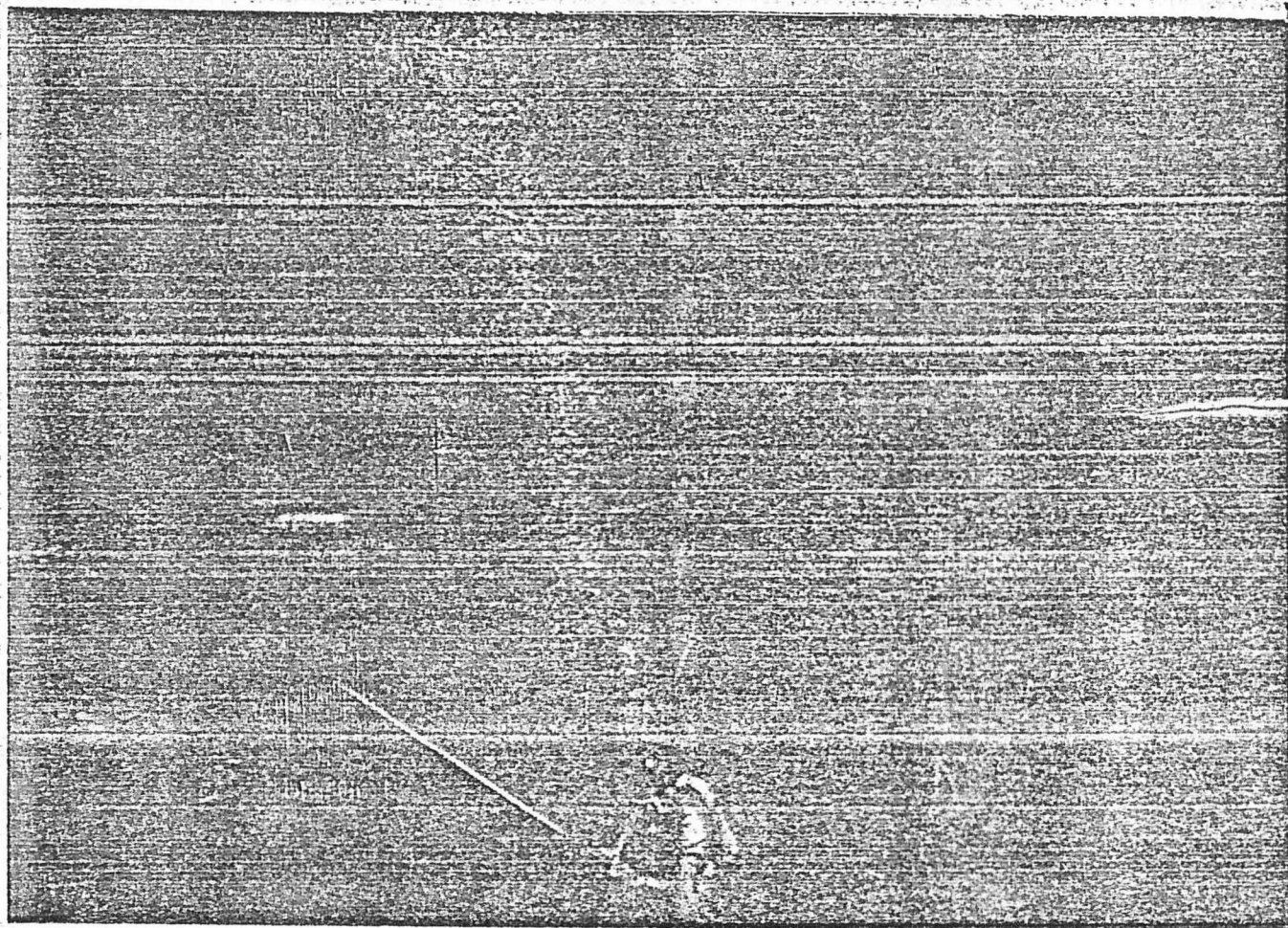
Until the widespread use of ferrous materials in ship construction eliminated the problems of hull destruction by marine borers, copper sheathing was used to cover the hull below the water line. This section, previously removed from the shipwreck, is the same as the material found by the Submerged Cultural Resources Unit on the shipwreck site in Utwa Harbor.



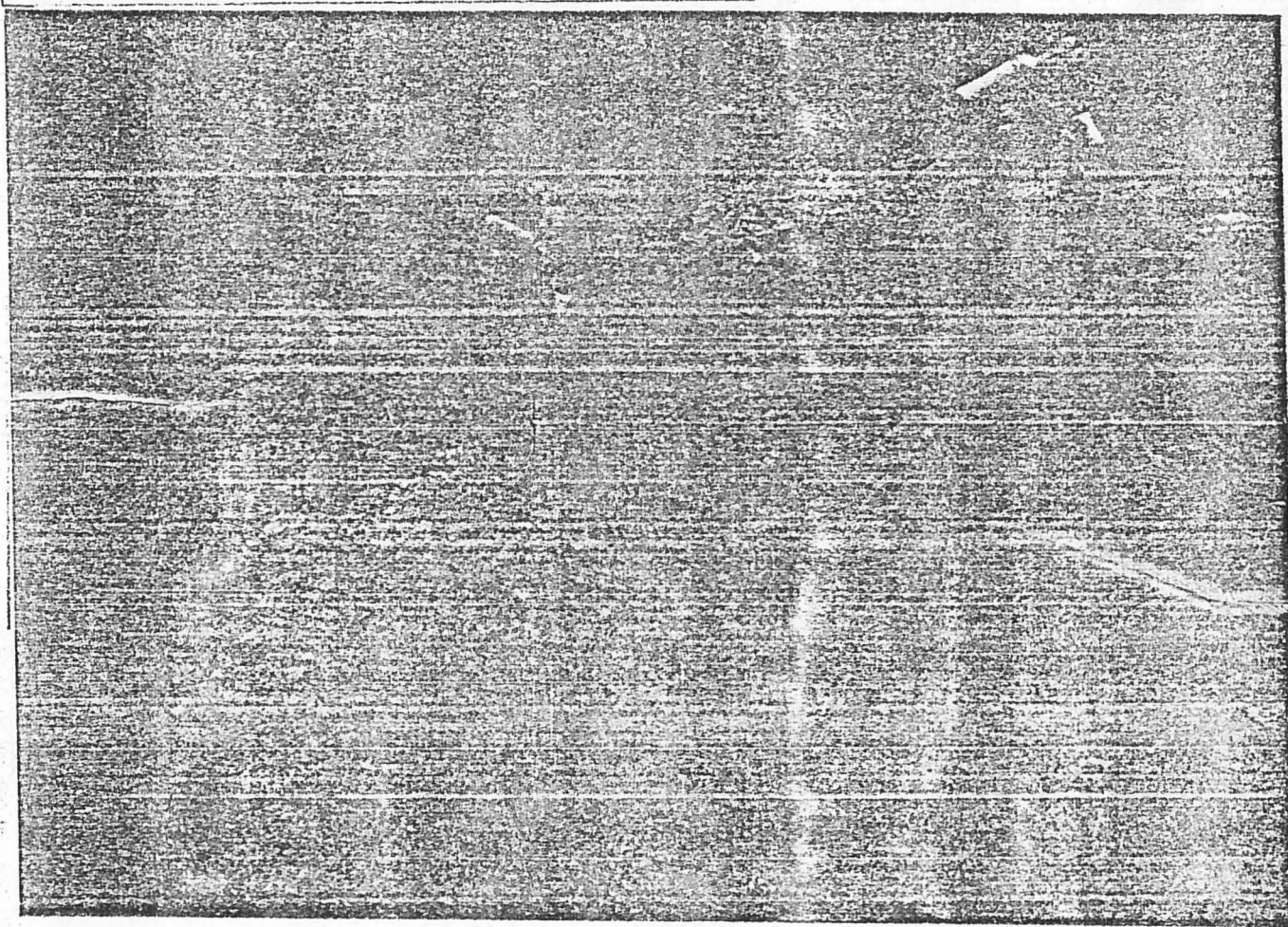
This view of Feature 5 contains articulated sheathing in situ along with an unidentified iron piece partially buried by a coralhead. Nails and nail holes form readily discernible linear patterns.



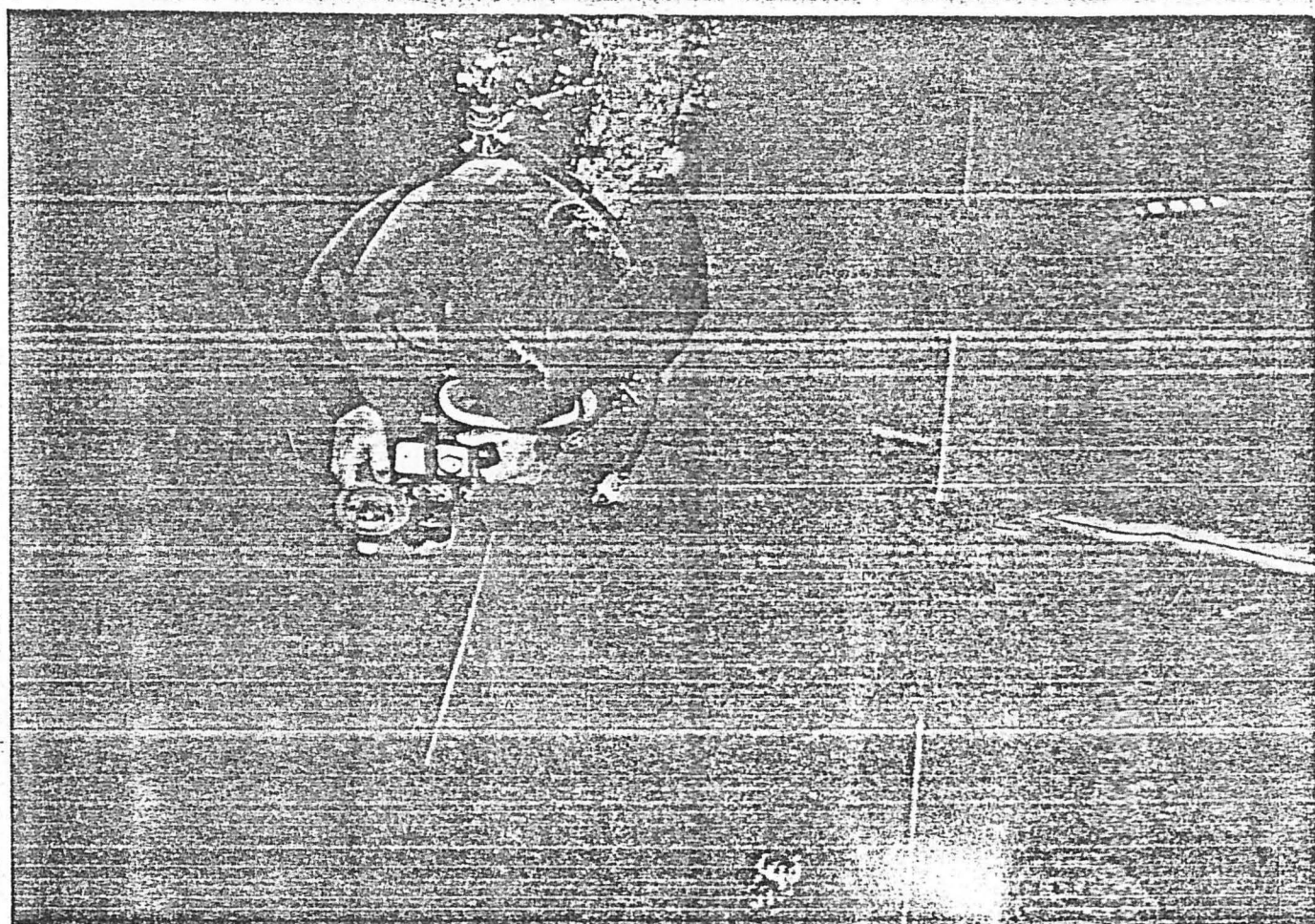
A planning session was held each morning to specifically outline the work to be completed on-site and review procedures. Dan Lenihan (center) discusses mapping operations with Bob Adair (left), a Peace Corps volunteer, and Paul Ehrlich (right), the project historian.



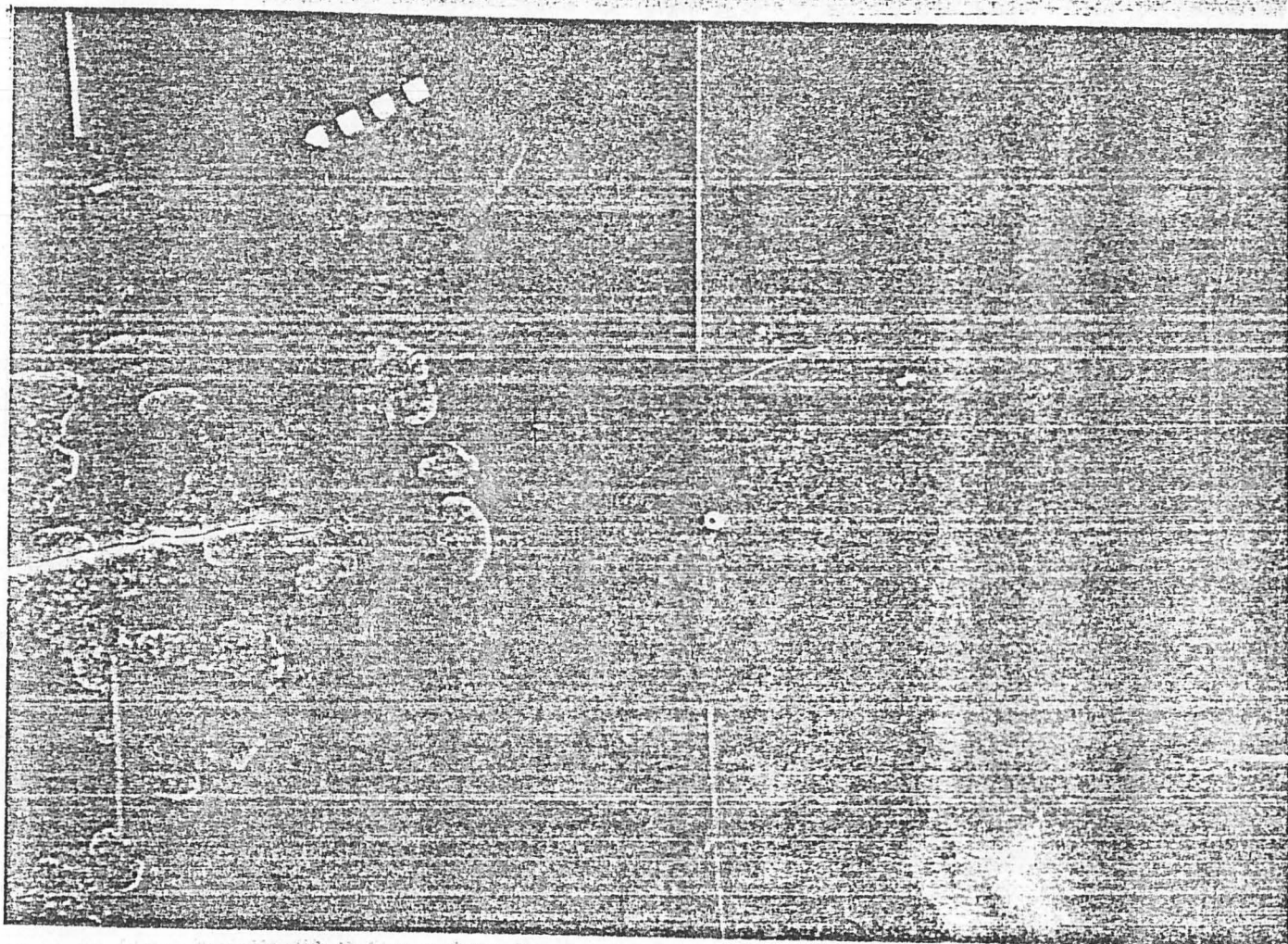
Triangulation off a pre-marked baseline was the mapping method used by the Submerged Cultural Resources Unit to plot the scattered areas of wreckage. This information was recorded on-site and later transferred to a plan map.



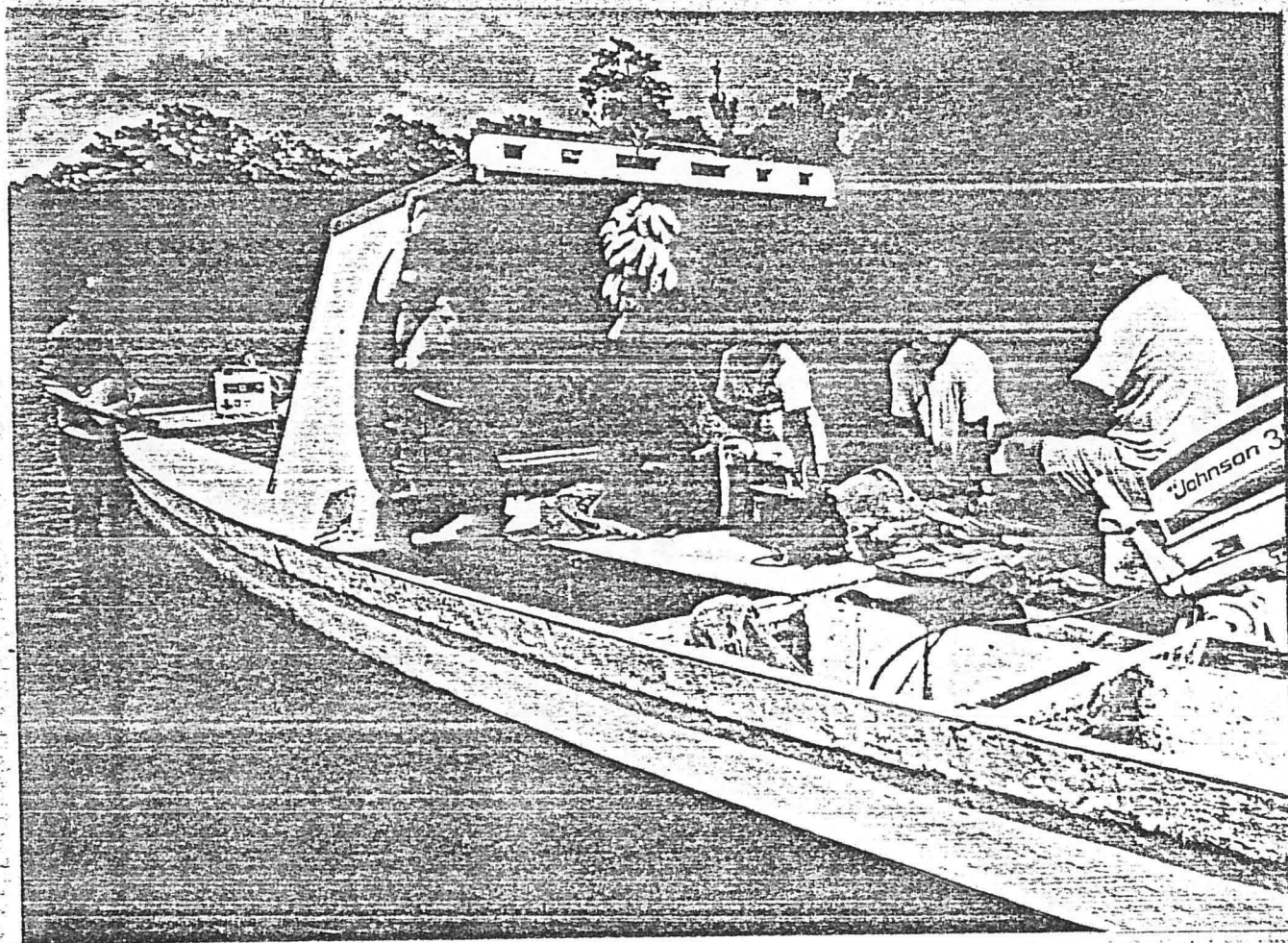
The Submerged Cultural Resources Unit archeologists photographed and sketched the prominent site features. The site area, bounded on the east by a coral reef, extended for 13 meters along the Uwa River bed at depths ranging from 25 to 40 feet.



A semi-controlled photomosaic, using both black and white and color film, was undertaken for use as a baseline of site condition and relative positions of wreck materials. Here Larry Murphy levels the camera over the mosaic lines.



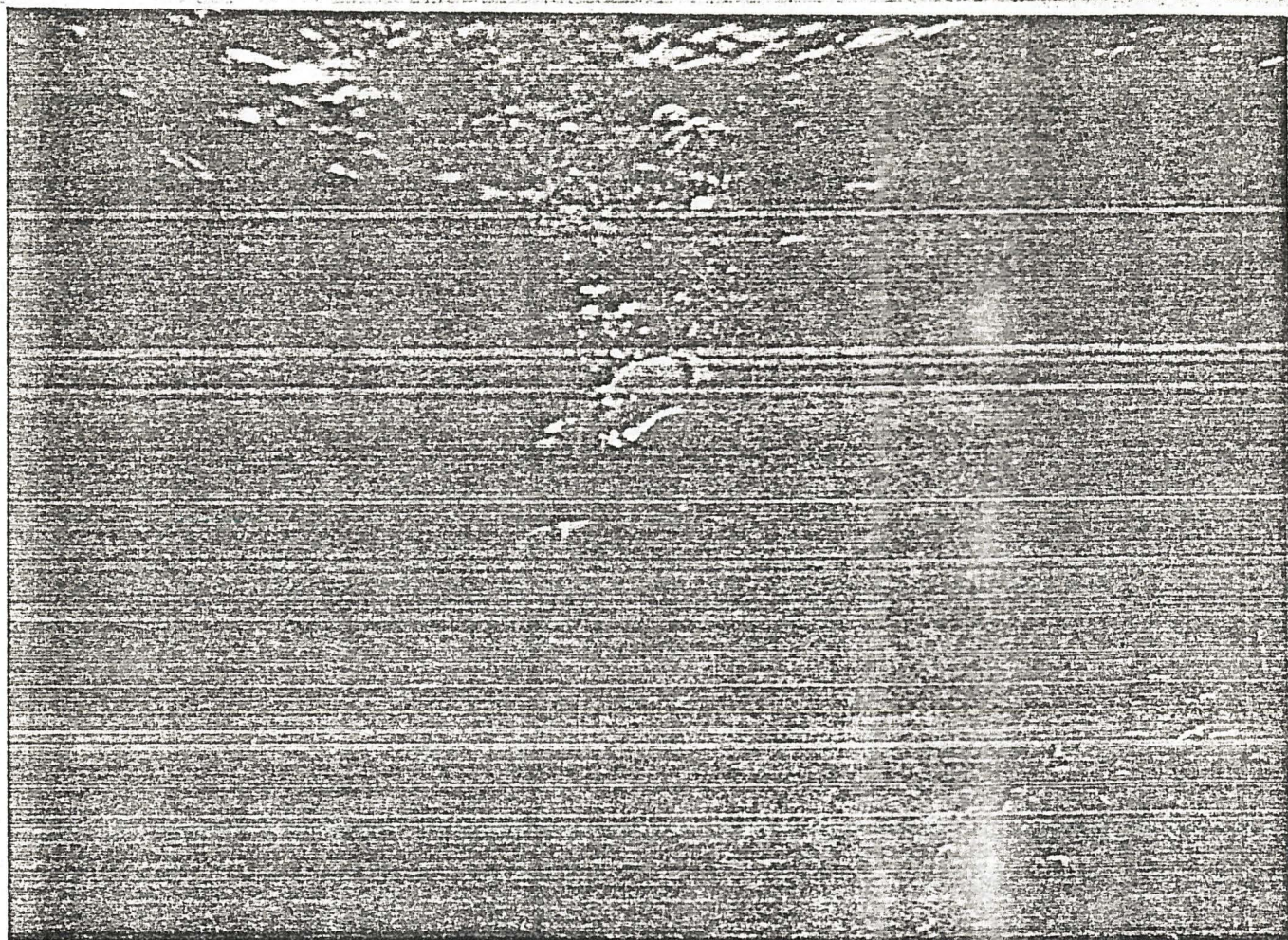
The photomosaic is composed of numerous pictures similar to this. The light circle in the center is a plumb-bob which was hung from the camera. This helped the diver maintain a specific distance above the site. Ballast (lower center) and a long iron piece (mid-left) are clearly in evidence in this photo taken from approximately 2 meters above the site.



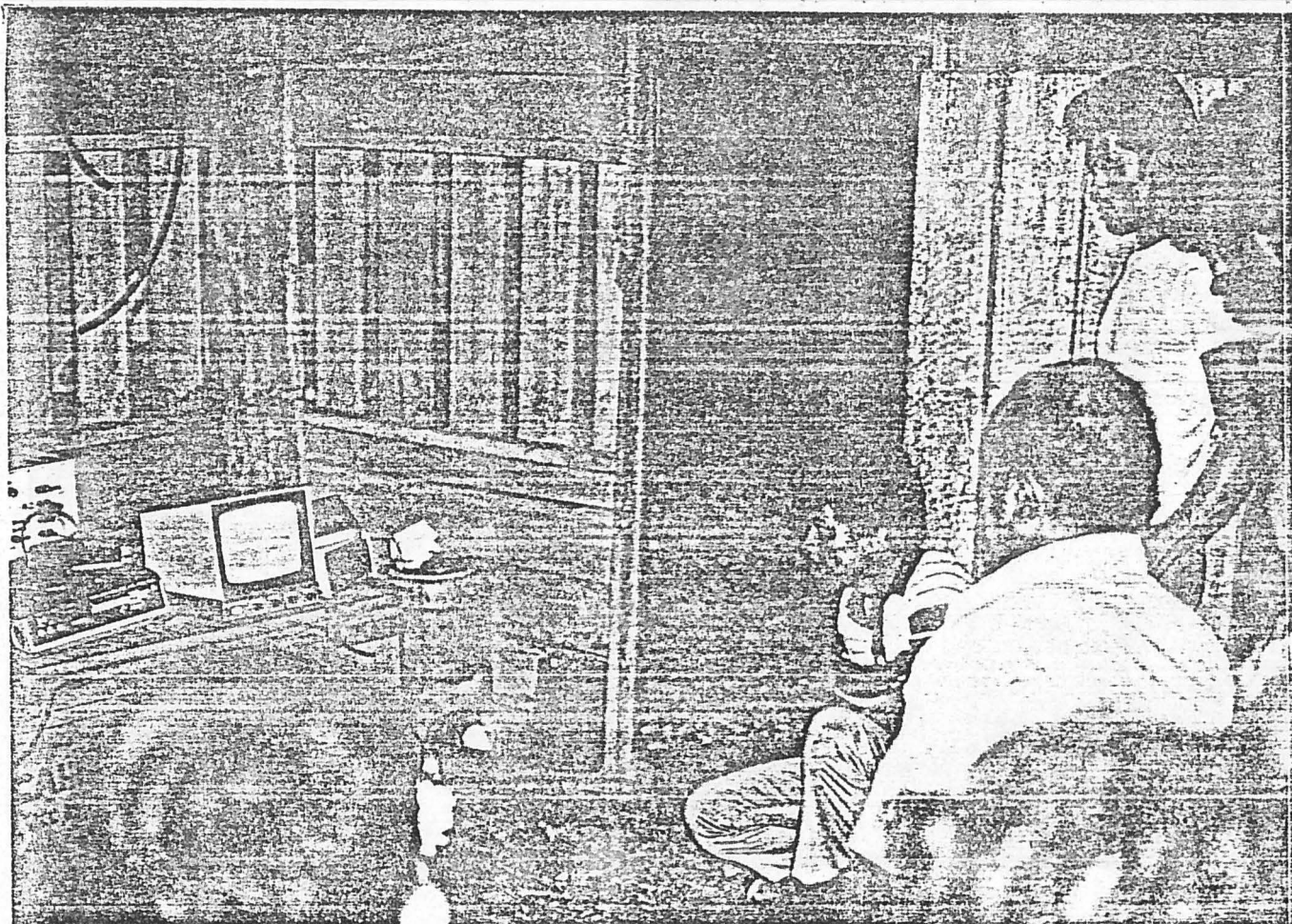
A twin-hulled fishing boat was used to transport people and gear out to site. Tomi Carrell (center) is setting up and pre-testing the video equipment while Dan Lenihan, Teddy John, Julian Jonah and Marston look on.



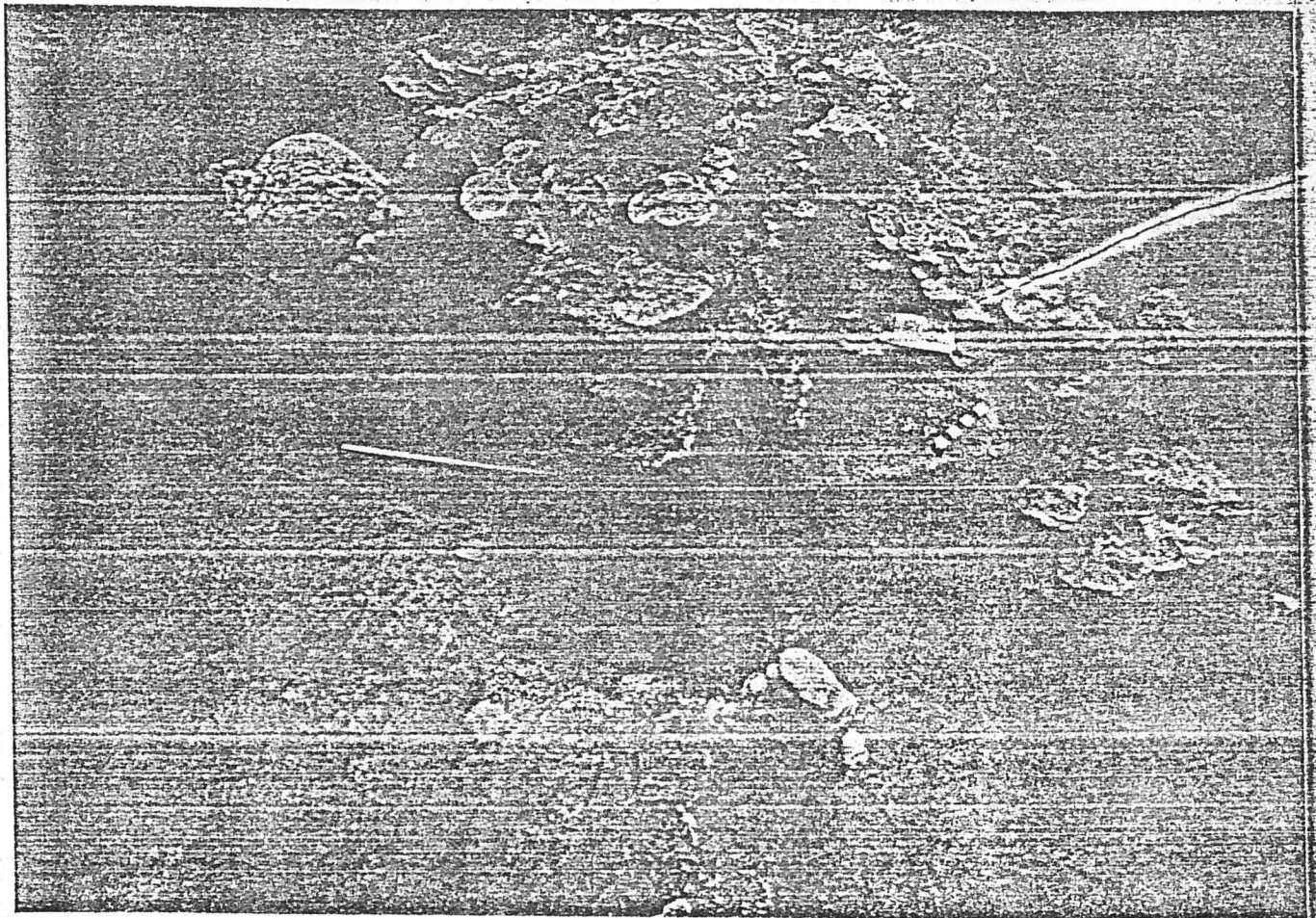
Chief Kan Isiah (right center) visited the site to observe the Submerged Cultural Resources Unit videotaping the shipwreck. His active interest and support of the wreck investigations facilitated successful completion of the shipwreck evaluation.



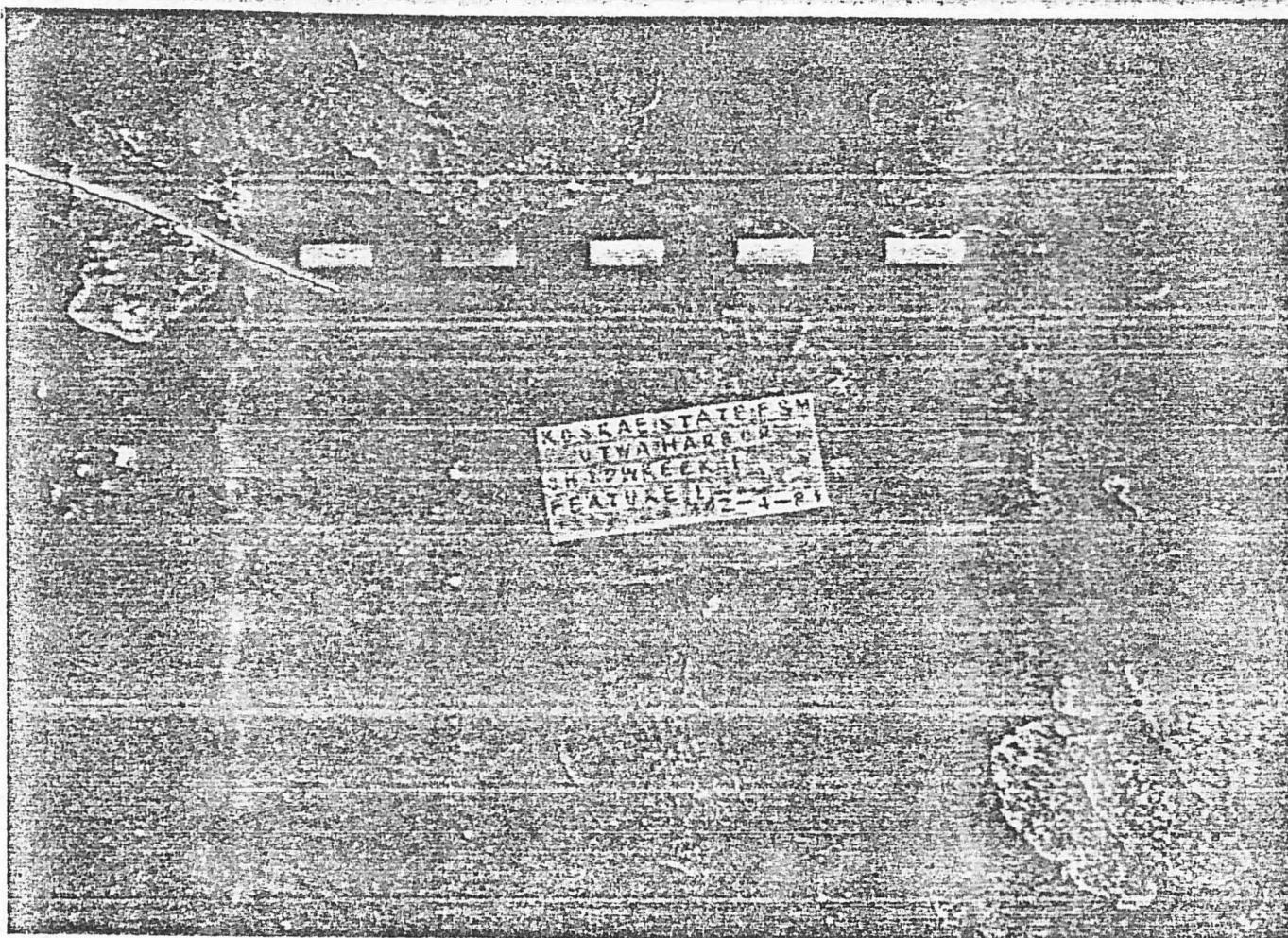
Obtaining a videotape of the wreck site was one of the objectives in the site evaluation. This tape was used later by the Submerged Cultural Resources Unit to supplement field notes and review the condition of selected artifacts.



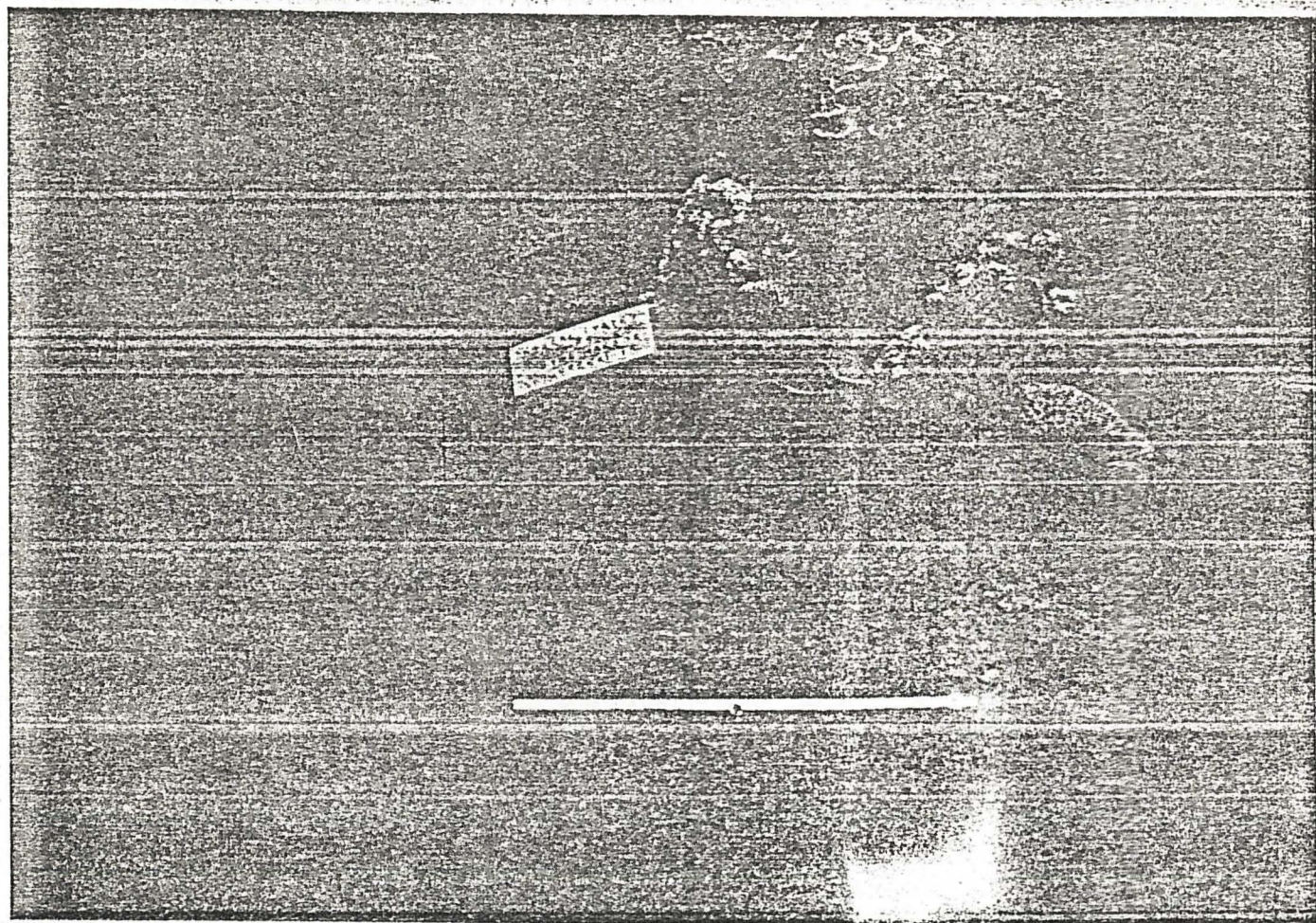
The videotape of the wreck site was shown to the Chief of Utwa and others in the village. This was the first time that a TV or video had every been seen in this village, and the first opportunity for many of the people to see the shipwreck in Utwa Harbor.



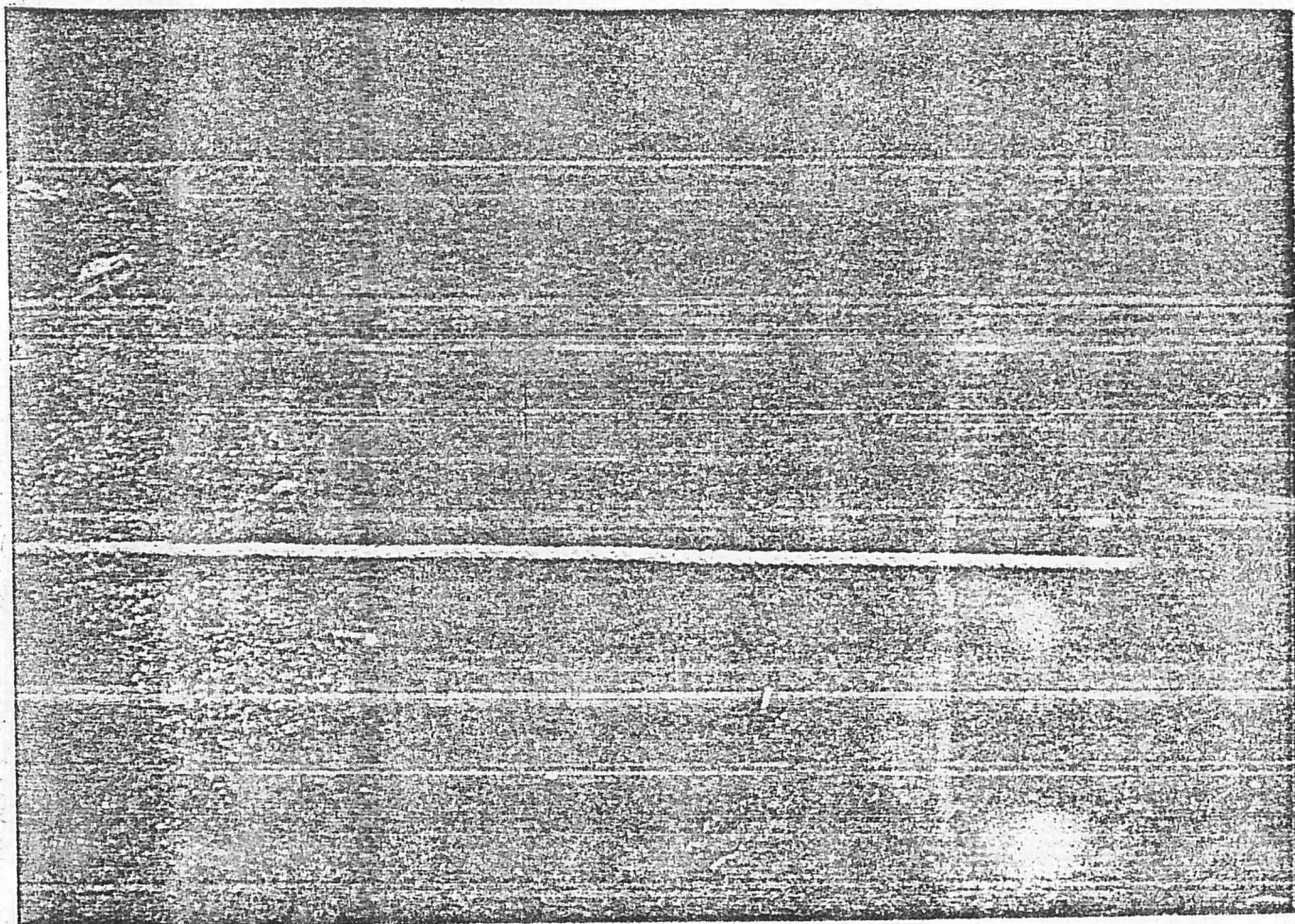
A prominent piece on the wreck site was Feature 1, a large, copper sheathed, rectangular structure partially buried by coral growth.



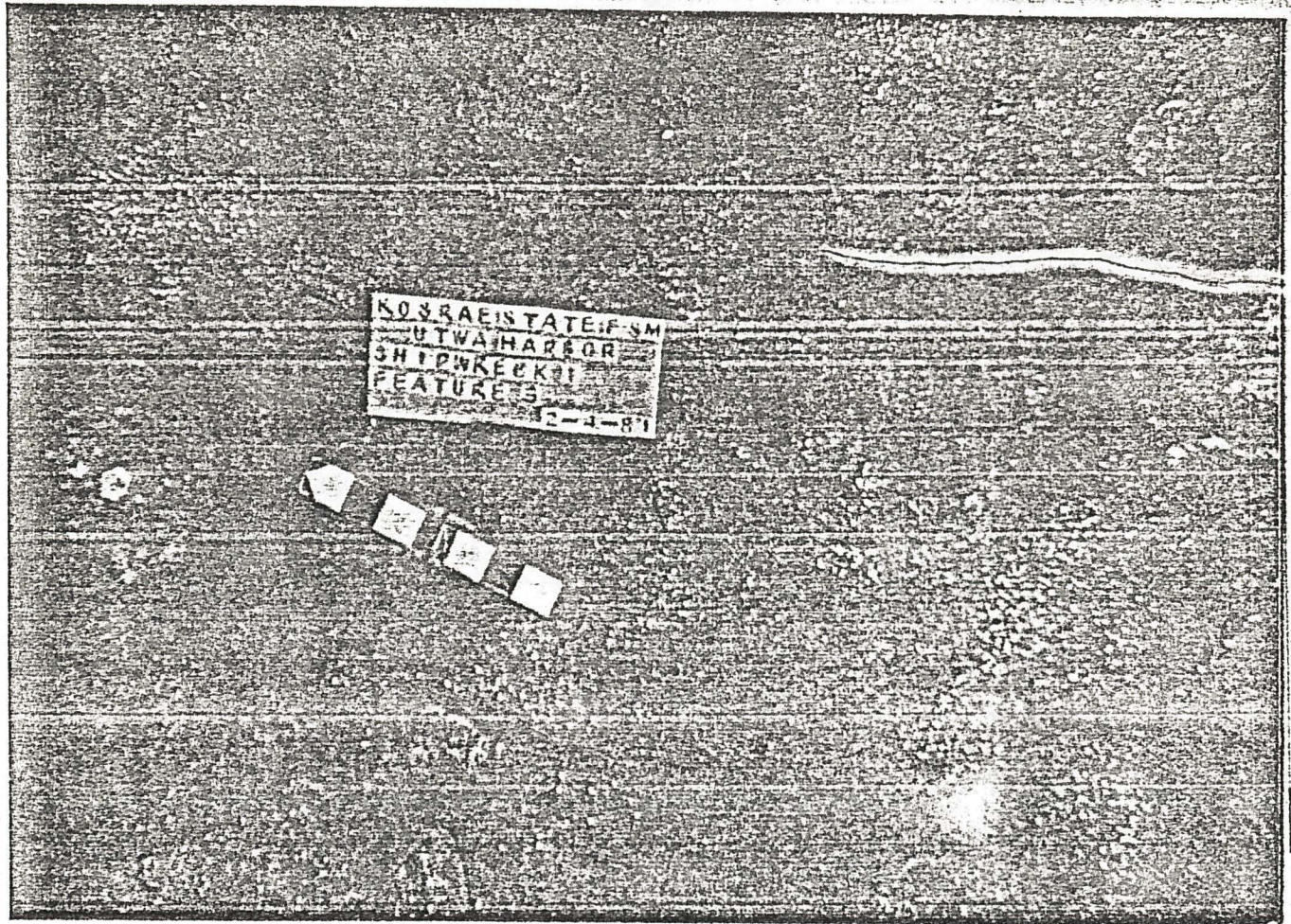
Over 3 meters in length, Feature 1 is in an excellent state of preservation.



Feature 7: Two heavily encrusted uprights partially buried in the river silt. The sedimentation from the river, over 2 meters deep, may have acted as a preservative, sealing much of the wreckage off from depredation by visitors and deterioration from marine organisms.

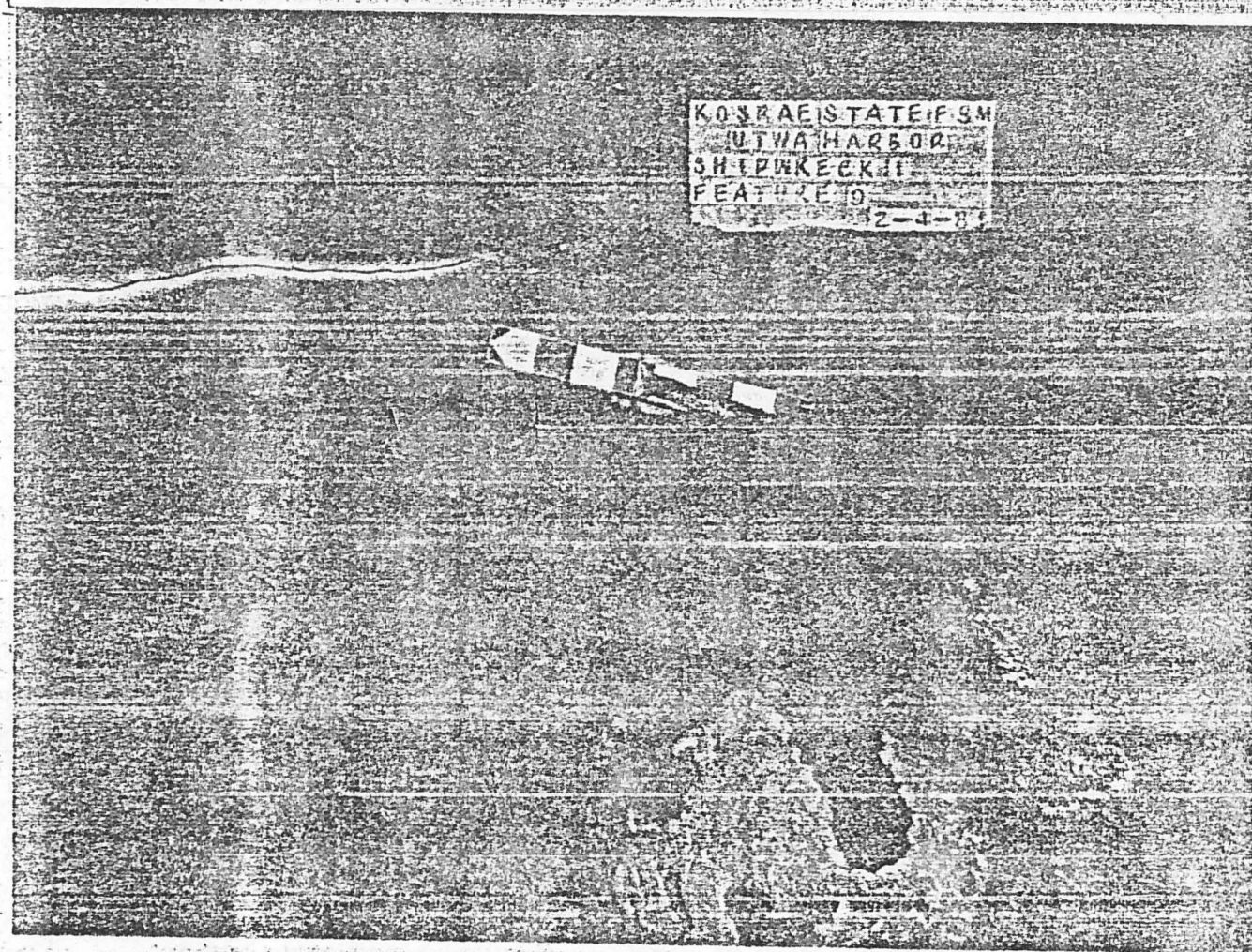


Preserved wood (lower right) on the site may have been protected by a thin mantle of silt. This type of preservation is not unusual where a sand cover or siltation is present.



A large concentration of rock ballast was designated as Feature 3. The ballast was clearly in evidence and not buried by river sediments.

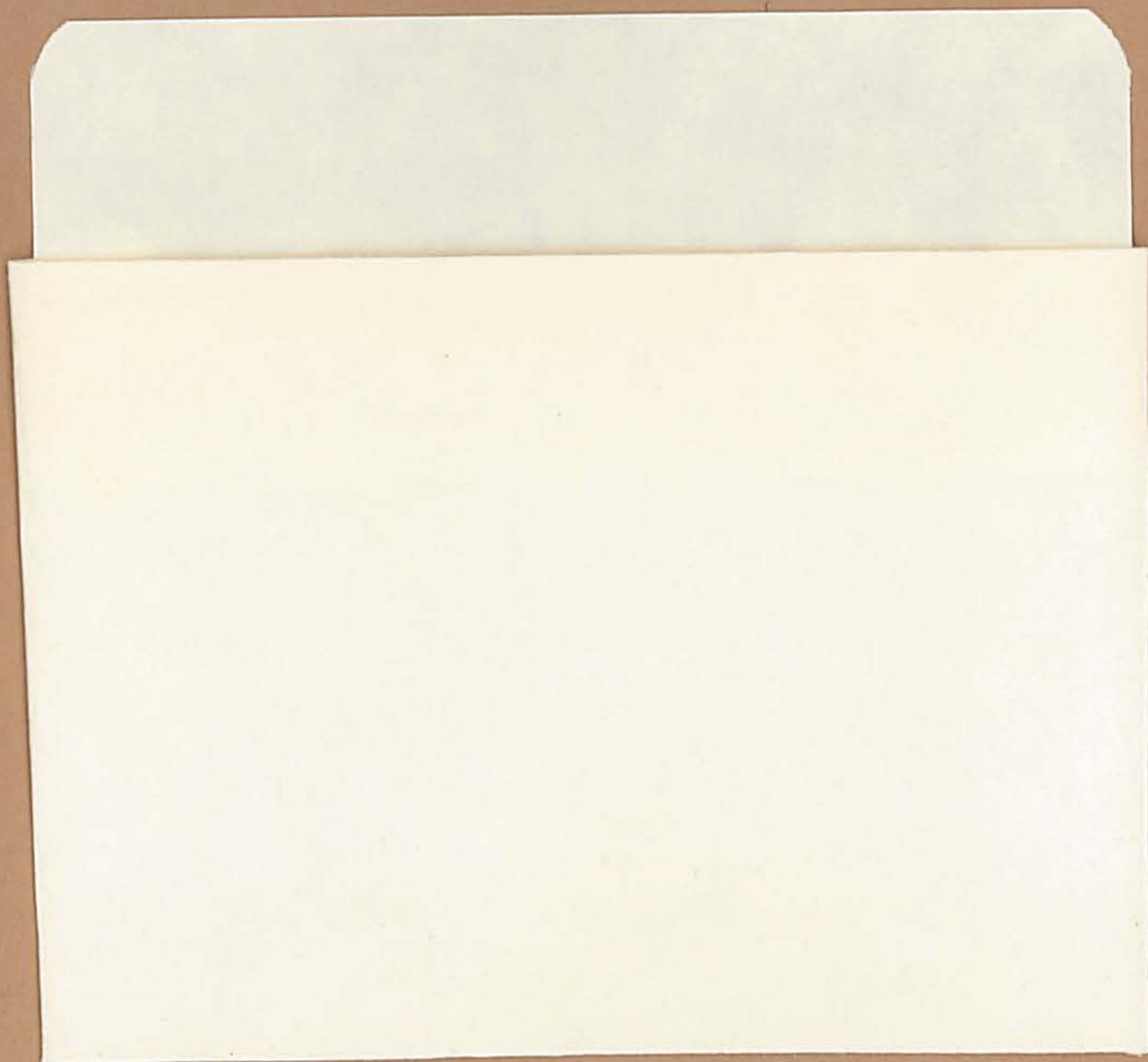
KOSRAE ISLAND FSM
UTWA HARBOUR
SHIPWRECK II
FEATURE 9
12-4-81



Feature 9: A large brass pin in an iron member, only partially buried by silt, was located on-site. A similar artifact, designated as Feature 6, was found elsewhere on the site.



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